

REVERSE AUCTION BIDDING – ARTIFICIALLY INTELLIGENT PLAYER’S
INTERFERENCE WITH OTHER BIDDERS

A Thesis

by

MENGYA ZENG

Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Chair of Committee,	John M. Nichols
Committee Members,	Leslie Feigenbaum
	Kevin T. Glowacki
Head of Department,	Josep P. Horlen

May 2015

Major Subject: Construction Management

Copyright 2015 Mengya Zeng

ABSTRACT

Reverse Auction Bidding is not a new procurement method in the construction industry. Unlike a traditional auction system, the Reverse Auction bidding system uses a bidding activities method completed anonymously using prequalified bidders during a certain auction time period or with a known end constraint. The basic premise for the auction is that the current best auction price can be seen through the whole auction process by both bidders and owner. The incentive is for noncompetitive bidders to lower the price. The study of Reverse Auction Bidding was first introduced to Texas A&M University in 2004, and continue with a series of study. This study is an ongoing study into the purchase of goods from a set of suppliers by a single purchaser. This research has progressed to new stage of introducing of an AI Player. A previous study proved that a human surrogate from the owner side could interfere with the free market. This research tried to find out a series of rules and regulations for the AI Player to drive down the profit to the owner's side. During the research, three human bidders and one AI Player participated in a new Reverse Auction game. The time intervals and bidding amounts of this new game were recorded, which provided the basic information to the research for her further analysis. The result showed that the AI Player was spotted by the bidders, and AI bidder was neutralized effectively from the game, where the other bidders returned to normal play. Further studies are still needed to explore the time rules for the AI Player.

DEDICATION

To my loved Dr. Nichols.

ACKNOWLEDGEMENTS

I would like to thank my committee chair, Dr. John Nichols, and my committee members, Dr. Leslie Feigenbaum and Dr. Kevin T. Glowacki, for their guidance, help and support throughout this research. Especially for Dr. Nichols, he gave me tremendous encouragement and help when I encountered difficulties in preparing the reverse auction experiment. On the other hand, he enlightened me by his wisdom life philosophy. He is my real mentor.

Thanks to all the professors in the department of Construction Science. It was your wonderful teaching that made me have a better understanding about my major and my research.

Thanks to my family who support me all the time. Even though you are in China, I can still feel that you are standing by my side and give me so much confident.

Thanks to all my friends here in Texas A&M University and in China. Without your help, my research process would not go so smoothly. Special thanks to my classmates who volunteered in my experiment, it was your precious time and wonderful participation that facilitated my research process.

NOMENCLATURE

RAB	Reverse Auction Bidding
KTS	Keirsey Temperament Sorter
RAB	Reverse Auction Bidding
SQL	Sequential Query Language
TAMU	Texas A&M University

TABLE OF CONTENTS

	Page
ABSTRACT	ii
DEDICATION	iii
ACKNOWLEDGEMENTS	iv
NOMENCLATURE	v
TABLE OF CONTENTS	vi
LIST OF FIGURES	viii
LIST OF TABLES	x
CHAPTER I INTRODUCTION	1
Background to the Study	1
Problem Statement	2
Sub Problems	2
Hypotheses and Main Objectives	3
Delimitations of the Study	3
CHAPTER II LITERATURE REVIEW	5
Traditional Reverse Auction Bidding Procedure	5
Issues Raised from RAB	6
Definitions	8
Game Type	16
Personality Test	17
Trends Periods During the Game	19
Review of the Reverse Auction Game	21
CHAPTER III METHODOLOGY	28
Introduction	28
Game Setup	28
Data Collection	32

CHAPTER IV RESULTS	36
Introduction	36
Results of the Game	36
Analysis	42
CHAPTER V CONCLUSION	61
REFERENCES	63
APPENDIX A THE KEIRSEY TEMPERAMENT SORTER	66
APPENDIX B KIERSEY TEMPERAMENT SORTER SCORING.....	72
APPENDIX C ASP PROGRAM	74

LIST OF FIGURES

	Page
Figure 1 Profit to Different Jobs for Four Bidders (Zhou, 2010).....	20
Figure 2 Reverse Auction Bidding General Algorithm.....	21
Figure 3 The Login Screen for the Game.....	22
Figure 4 Construction Site Location in Houston (Google Maps, 2004)	23
Figure 5 Rain Probability in Houston (after NOAA, 2012)	25
Figure 6 All Current Bids Screen	32
Figure 7 Bank Guarantee Form	33
Figure 8 Higher than Acceptable Bid Screen	33
Figure 9 Jobs in Progress Screen.....	34
Figure 10 All Completed Jobs Screen.....	35
Figure 11 Profit Efficiency.....	43
Figure 12 Profit against Job Number in 8 Weeks	44
Figure 13 Profit against Job Number in Week #3	46
Figure 14 Profit against Job Number in Week #8	47
Figure 15 Profit against Job Number in Week #2	48
Figure 16 Profit against Job Number in Week #5	48
Figure 17 Profit against Job Number in Week #7	49
Figure 18 Profit against Job Number in Week #4	50
Figure 19 Profit against Job Number in Week #6	50

Figure 20 Bids Submitted during Job No. 26.....	52
Figure 21 Bid Submitted during Job No.27	53
Figure 22 Bids Submitted during Job No. 28.....	54
Figure 23 User #1 (AI Player)'s Profit Percentage History	55
Figure 24 User #2 (Driver Co.)'s Profit Percentage History.....	57
Figure 25 User #3 (Pliers Co.)'s Profit Percentage History.....	59
Figure 26 User #4 (Pliers Co.)'s Profit Percentage History.....	60

LIST OF TABLES

	Page
Table 1 KTS Different Personality Types	17
Table 2 Summary of Individual Components of the Different Personality Types.....	18
Table 3 Trend Periods and Data as Postulated by Chouhan (2009).....	19
Table 4 Location of the Construction Site in Houston.....	24
Table 5 Rain Data for One Week	26
Table 6 Location of the Construction Sites in Houston	30
Table 7 Number of Job per Week and Descriptive Statistics.....	31
Table 8 Player and Personality Type.....	36
Table 9 First Bid Session	38
Table 10 Second Bid Session	38
Table 11 Third Bid Session	39
Table 12 Fourth Bid Session	39
Table 13 Fifth Bid Session	40
Table 14 Sixth Bid Session	40
Table 15 Seventh Bid Session	41
Table 16 Eighth Bid Session	41
Table 17 Bid Efficiency and Profit Efficiency	42
Table 18 Avg. Profit Earned in Each Section	45
Table 19 Bids Submitted during Job No.26	52

Table 20 Bid Submitted during Job No.27	54
Table 21 Bids Submitted during Job No.28	55
Table 22 User #1 (AI Player)'s Bidding Data	56
Table 23 User #2 (Driver Co.)'s Bidding Data.....	57
Table 24 User #3 (Pliers Co.)'s Bidding Data	58
Table 25 User #4 (Concrete Co.)'s Bidding Data.....	59

CHAPTER I

INTRODUCTION

BACKGROUND TO THE STUDY

The construction industry is now a huge and expanding market with considerable profit. However, the parties involved in this industry, such as general contractors, subcontractors, designers and suppliers, still face the problem of rising costs, increasing competition, high failure rates and marginal rates of return. In this situation, more and more people from private companies and governmental agencies started adopting Reverse Auction Bidding (RAB), hoping that RAB could drive costs down and rise the productivity in some way for the owner.

Unlike traditional bidding, RAB is a type of auction in which the roles of two parties are reversed. The traditional bidding method is called sealed-bid auction, which allows all the bidders to submit their bid proposals at the same time to the owner. Each bidder can submit his or her bid only once, and therefore cannot revise the bid to further compete with others. Then, the owner will determine who will get the project depending on the best value or the lowest price (Wamuziri and Abu-Shaaban, 2005). Much different from the traditional sealed-bid auction, RAB is a one-sided, descending, open bid. Since the bid prices are visible to all participants during the process of the auction, the qualified bidders can continue to cut their own prices to compete with the current lowest bid price a number of times until time is expired (Horlen, Eldin, and Ajinkya, 2005). The owner will then award the job to the bidder who submits the lowest price. So,

from the owner's perspective, the RAB reduces the costs and increases the efficiency of bidding.

The study of Reverse Auction Bidding was first introduced to Texas A&M University in 2004, and continue with a series of study. This study is an ongoing study into the purchase of goods from a set of suppliers by a single purchaser.

PROBLEM STATEMENT

The purpose of this study is to determine if an Artificially Intelligent (AI) Player can interfere with the Reverse Auction Bidding (RAB) Process, lowering the overall prices to the owner's benefit, without being detected by the human players in the game.

SUB PROBLEMS

The sub problems are:

1. Develop a set of rules for an AI Player who seeks to reduce overall costs for the owner. In the RAB game, this means that one of the λ players will act in concert with the owner. This is not in the overall best interests of the λ player group.
2. Using deception play the game as if the AI player was human, in this case the research will act as the surrogate.
3. Using standard statistical techniques review the returns in the game and compare them to known returns for unbiased games.
4. Interview the other players to determine if they were concerned about aspects of the play to see if there was apparent interference.

HYPOTHESES AND MAIN OBJECTIVES

This study will test the hypothesis that the AI Player's interference with RAB Process is detectable.

The objectives of this study are:

1. To determine the changes to the standard statistical model that would appear in the case of owner interference, and how the statistical distribution function changes.
2. To determine the rules that need to be used to maintain the secrecy of the action for all others.

DELIMITATIONS OF THE STUDY

The delimitations of the study are:

1. The data collected in this study will be the result of bidding process.
2. All participants of this study were graduate students from the Department of Construction Science at Texas A&M University. These participants were selected randomly and had no prior experience in RAB. The sample size is relatively small and lacking diversity in background and age.
3. This study was undertaken in controlled settings with limited variables that exist in a real market place to allow this study to focus on the bidding patterns of the bidders.
4. The economic conditions that may have adverse impacts on the bidding process are supposed to be steady during the study period.

5. The AI Player's behavior is clearly unethical and illegal; these issues are ignored in the study.

CHAPTER II

LITERATURE REVIEW

Auction is a method to procure goods and services. There are different types of traditional auctions, such as English auction, Dutch auction, Vickrey auction, and sealed-bid auction (Horlen et al., 2005). Reverse auction bidding is a variant of the Dutch auction. It is a relatively new type of auction that was introduced in the mid-1990s as Business-to-Business (B2B) online Reverse Auction (Schoenherr and Mabert, 2007). This bidding method is very different from the sealed-bid auction, which is the traditional procurement method used in construction industry until the early 1990s. In the sealed-bid auction, all bidders submit bid simultaneously without knowing the bid of any other bidders. The lowest bidder is awarded at the price submitted (Kleijnen and Van Schaik, 2011). In contrast, all bidders will be informed about the current best quote during the RAB process through online system. In addition, each bidder is able to submit a bid multiple times, until auction time expires.

TRADITIONAL REVERSE AUCTION BIDDING PROCEDURE

The reverse auction bidding is not only comprised of the owners and the bidders, but also a secure protocol. The secure protocol is an Online Trusted Third Party (TTP), which needs to be certified form Certification Authority (CA). In RAB system, the owner is the buyer and the bidder is the seller. The TTP provides a platform for the buyer and seller to conduct their business (Srinath, Samrat et al. 2011).

Generally, an RAB will begin with a thorough definition of the requirement. The RAB requests that all the bidders need to share a common understanding of the required supplies and services. Specifications, drawings, and bid documents about the goods or services are provided by the owner at the beginning. The owner needs to provide descriptions as clearly as possible to ensure the successful of the RAB. Secondly, the owner should screen service providers depending on their ability and past performance. Then, the owner will determine the bidding rules, the market clearing rules, and the information enclosure rules. Thirdly, the owner should screen the registered bidders and provide training to these pre-qualified bidders. After the training, all the bidders need to understand the auctioning software, the auction duration, rules regarding overtime, and how to handle contingencies during the bidding. Finally, the owner conducts the bidding events and awards the project to the successful bidder(s) after the closing of the auction (Hawkins, Coyne and Hudgens, 2009).

ISSUES RAISED FROM RAB

A number of owners, both private and public, adopt the online reverse auctions as the bidding technique for their construction projects. Some proponents claimed that the benefits of RAB included savings on the cost of goods and services, the reduction of award cycle-time, the increased bidding transparency, the higher price visibility, and the access to a larger supplier base (Hawkin et al, 2009; Manoochehri and Lindsay, 2008).

However, the use of RAB still remains questionable. The opponents comment on the RAB negatively for the following reasons. Firstly, Schoenherr and Mabert (2007) blamed reverse auction for its “price only” attribute, because the owner would only take

price into consideration, and ignore the non-price factors, such as quality and reputation. In order to get the bid, the bidding parties are forced to reduce prices below their lowest acceptable bid prices. If the winning bidder recognizes that their company is losing money during project execution, he or she will have no choice but to use low quality materials, poor workmanship, and proliferation of claims (Wamuziri et al., 2005). Therefore, the quality of the project and safe work conditions cannot be guaranteed. (Hatipkarasulu and Gill, 2004) Secondly, since price becomes the relatively decisive element in RAB, the RAB cannot protect the healthy long-term relationship between owners and contractors (Horlen, 2005). As Ray, Jenamani, and Mohapatra (2009) stated in their research, the RAB degrades the buyer-supplier relationship, and some pre-qualified bidders may lose the interest to participate in subsequent auctions. Thirdly, RAB does not guarantee the lowest price. Furthermore, Mabert and Skeels (2002) pointed out that the saving in RAB would not be conspicuous until the “real market price” was identified.

Sometimes, bids do not necessarily need to be awarded to the lowest bidder. The owner can make decision based on multi-attribute evaluations of the bidders. In a multi-attribute RAB, the owner should determine the main attributes of a good or service according to their actual needs. Then, the weight of each attribute should be figured out respectively. At the end of the bidding process, the bidder with high scores will be chosen to be the winner in the RAB (Yuan, 2012).

DEFINITIONS

There are a lot of arguments on RAB on the aspects of ethics, operations, and interference. To determine whether RAB is a success or not, research need to focus on the study of the owners and bidders' behaviors (Van Vleet II, 2004). Recently, the RAB study group in Texas A&M University attempts to introduce an AI Player that controlled from the owner's side to deepen the understanding of bidder's behaviors. Even though the game procedure is changed, the definitions used in the game are the same as the previous studies. The terms used in this research have been established by van Vleet (2004), Gregory (2006), Guhya (2010). These necessary definitions are:

λ player	This represents the bidder group, treated as a single entity for the purpose of game analysis.
λ_i player	The i^{th} bidder in the bidding group.
ν player	This represents the purchaser.
α game	The postulated sub-game played between bidders in seeking economic advantage over the remaining bidders. This game almost always disadvantages the ν player, but the ν player created the system and so is responsible for the ν player's economic losses as a result.
ω game	The postulated sub-game played within the Reverse Auction Bidding game between the purchaser and the bidders. In terms of this analysis, it is deemed to effectively

reduce to a two-player game, with competition implications for all players. The ν player in reality sees only the average of all won bids.

τ	Bid time allowed for each round of play in the game.
δ	Period between bid time τ that represents the work time in the game.
B_j	i^{th} bid
B_ν	Accepted bid for each job.
K	This variable is a fixed dollar sum, representing the ν player's base price, although in this game K is a vector of costs.
Γ	This variable is a fixed dollar sum, representing the ν player's maximum incremental price above K
Ξ	This variable is normally defined by the set of numbers $\{\Xi 0 < \Xi \leq 1\}$, although negative values of Ξ are permitted by the Reverse Auction Bidding system. Ξ is used to normalize the profit data. A negative Ξ_j represents a loss on direct costs to the λ_i player who makes this type of bid, and enough of these bids will lead to a bankrupt player. This type of play is discouraged as the assumption in the game is steady state economic conditions in the outside economy.

Future studies may look at a failing market, but that is beyond this study.

Bid: A single entry into the game that represents a legally acceptable offer to complete the work assuming the bidder has been prequalified.

Bidder: An entity that submits a bid. In this game, there are usually three to ten bidders, and each is an individual, rather than a company.

Bid Arrival: ‘a record when bid activity occurs and creates a bid track on online bidding system. This record includes bidding information like price, bidder time, etc. (Shu Yuan, 2013)

Bid Efficiency: is the ratio of the total number of jobs won to the total number of bids. This is one of the postulated metrics for determining success in the α game.

Case Study: ‘Designed to study intensely one set (or unit) of something; for e.g. programs, cities, counties, worksites-as a distinct whole, with the goal of understanding the set as a distinct whole in its particular context. A case study reveals the process and outcome at certain sites and the way in which these interrelate. Case studies are conducted primarily using qualitative techniques, but do not exclude quantitative data. (van Vleet 2004)’

Collusion: A secret agreement between two or more parties for a fraudulent, illegal or deceitful purpose (van Vleet 2004). Or as defined by the OED as ‘secret agreement or understanding for the purpose of trickery or fraud’, is generally considered to be reprehensible and is usually illegal in a free market system, because of the economic distortions introduced into the market.

Economic Winner: An individual who generated the highest average returns. Panchal (2007) coined this term to indicate a more successful player in the α game. An economic winner makes no direct difference to the ω game for the ν player where the ν player has an objective of minimizing the average bid for the game. The ν player sees the average price for purchases and a distribution of prices (Guhya, 2010).

Economic Loser: An individual who generated the lowest average returns. Panchel (2007) coined this term to indicate a less successful player in the α game. An economic loser makes no direct difference to the ω game for the ν player where the ν player has an objective of minimizing the average bid for the game (Guhya, 2010).

- Efficiency: The ratio of the output to the input of any system.
- Game: a series of jobs for the construction of a reinforced concrete floor slab, each game lasts approximately 8 to 10 weeks in game play time, with each round of the game modelling a week and occurring in a 20 minute period, with 15 minutes of bid time and 5 minutes of build time (Guhya, 2010).
- Game Theory: A formal analysis of conflict and cooperation among intelligent and rational decision makers (van Vleet, 2004).
- Herfindahl Index: a measure of the size of firms in relationship to the industry and an indicator of the amount of competition among them. It is defined as the sum of the squares of the market shares of each individual firm. As such, it can range from 0 to 10,000, moving from a very large amount of very small firms to a single monopolistic producer. Decreases in the Herfindahl Index generally indicate a loss of pricing power and an increase in competition, whereas increases imply the opposite. The Department of Justice considers Herfindahl indices between 1000 and 1800 to be moderately concentrated and indices above 1800 to be concentrated. As the market concentration increases, competition and efficiency decrease and the chances of collusion and monopoly increase. (van Vleet 2004).

<u>Job:</u>	A work unit, in this case a reinforced concrete slab for a home builder, taking 5 working days to construct.
<u>Loan Amount:</u>	It is a bank loan or a guarantee taken by the bidder with the purpose of increasing the bidders' job capacity. The cost is \$500 per job.
<u>Loss:</u>	negative return applied to a business undertaking after all operating expenses have been met.
<u>Lump Sum Offer :</u>	A tender submitted for a lump sum amount in the game assumed to be for a fixed price.
<u>Pre-Qualified</u>	The process of declaring competent or capable or to certify in advance. The purpose of pre – qualified is to maintain the economic competition.
<u>Profit:</u>	The return received on a business undertaking after all operating expenses have been met.
<u>Profit Efficiency:</u>	It is the ratio of the profit made to the number of jobs won. This is one of the postulated metrics for determining success in the α game.
<u>Purchaser:</u>	Either an owner or owner's representative who organizes the bid or tender document.
<u>Reverse Auction Bidding:</u>	It is a single or multiple-item, open, descending-price auction. The initiator specifies the opening bid price and bid decrement. Each bidder submits a successively lower bid.

At the end of the auction, the bidder with lowest bid value is being considered as a winner (van Vleet 2004).

Second Bidder Issue: It has been postulated that the lowest bidder in Reverse Auction Bidding is seeking to undercut the second bidder by the smallest quantifiable fragment, if the bidder understands the principles of tacit collusion (Chaudhari 2009). The hypothesis forms the basis for future research.

Sherman Antitrust Act: The act, based on the constitutional power of Congress to regulate interstate commerce, declared illegal every contract, combination (in the form of trust or otherwise), or conspiracy in restraint of interstate and foreign trade. According to Nichols (2010), the problem is tacit collusion does not fit within the meanings of the act, thus leading to the debate about the legality of RAB between contractors who consider it illegal or unethical and economists who accept the converse.

Tacit Collusion : Seemingly independent, but parallel actions among competing firms (mostly oligopolistic firms) in an industry that achieve higher prices and profits, much as if guided by an explicit collusion agreement. Also termed implicit collusion, the distinguishing feature of tacit collusion is the lack of any explicit agreement. The key is that each firm

seems to be acting independently, perhaps each responding to the same market conditions, but the end result is the same as an explicit agreement. This should be contrasted with explicit or overt collusion that does involve a formal, explicit agreement. Tacit collusion is observed in Reverse Auction Bidding, and is potentially related to the Second Bidder Issue (Chouhan, 2009). Nichols (2010) postulates that the α game has been observed and misunderstood as tacit collusion, in reality it can be viewed potentially reviewed as an aggressive player seeking a better than average return from the profit distribution resulting from the α game.

Traditional Bidding: In this type of auction all bidders simultaneously submit bids in such a way that no bidder knows the bid of any other participant. The highest/lowest bidder is assumed to be awarded at the price submitted provided no other contracts opened on the decision process (Chaudhari 2009)

Winners Curse: Problem faced by uninformed bidders or poor game players. For example, in an initial public offering uninformed participants are likely to purchase larger allotments of issues that informed participants know are overpriced.

GAME TYPE

Guhya (2010) suggested that the critical element of a Reverse Auction Bidding Game is what type of bids the \mathcal{U} player is willing to accept. He showed this type of bids by the introduction of an equation (1):

$$B_j = K + \Xi_j \Gamma \quad (1)$$

Γ presents the maximum incremental price above the nominal minimum bid amount K that a \mathcal{U} player is willing to pay in the game. Ξ is ranged from 0 to 1. When λ_i player makes a loss on direct costs for a certain type of bid, Ξ turns to negative, and enough of these bids will make the player bankrupt (Guhya, 2010). The concept of up approval limit was put forward by Feigenbaum (Nichols, 2010), who considered there had to be an upper limit everyone was prepared to pay for a service or good, the so called price point of economic theory.

τ shows the bid time allowed for each around of play in the game, which is 15 minutes in this case. The total cost for \mathcal{U} player can be shown in the second equation:

$$B_v = \sum_{j=1}^n B_j \quad (2)$$

During a round of play, the bidder group (λ player) submitted a valid bid, and the accepted lowest bidder is the winner of that round. In this case, each λ_i player then has a unique set of bids and jobs after the RAB game, with a total return to the λ_i player defined by a simple summation. However, the \mathcal{U} player's main focus is the average cost per job and the total cost for all jobs.

PERSONALITY TEST

Before the RAB game start, all the participants were asked to take a Keirsey Temperament Sorter (KTS) Test. The result of the Test is used to evaluation the personalities of these participants in this game. Table 1 illustrates sixteen different personality types.

Table 1 KTS Different Personality Types

	Tempera	Role	Role Variant
Intropective (N)	Idealist (NF)	Mentor (NFJ)	Teacher (ENFJ): <i>Educating</i>
		<i>Developing</i>	Counselor (INFJ): <i>Guiding</i>
	<i>Diplomatic</i>	Advocate (NFP)	Champion (ENFP): <i>Motivating</i>
		<i>Mediating</i>	Healer (INFP): <i>Conciliating</i>
	Rational (NT) <i>Strategic</i>	Coordinator (NTJ)	Field marshal (ENTJ): <i>Mobilizing</i>
		<i>Arranging</i>	Mastermind (INTJ): <i>Entailing</i>
		Engineer (NTP)	Inventor (ENTP): <i>Devising</i>
		<i>Constructing</i>	Architect (INTP): <i>Designing</i>
Observant (S)	Guardian (SJ)	Administrator (STJ)	Supervisor (ESTJ): <i>Enforcing</i>
		<i>Regulating</i>	Inspector (ISTJ): <i>Certifying</i>
	<i>Logistical</i>	Conservator (SFJ)	Provider (ESFJ): <i>Supplying</i>
		<i>Supporting</i>	Protector (ISFJ): <i>Securing</i>
	Artisan (SP) <i>Tactical</i>	Operator (STP)	Promoter (ESTP): <i>Persuading</i>
		<i>Expediting</i>	Crafter (ISTP): <i>Instrumenting</i>
		Entertainer (SFP)	Performer (ESFP):
		<i>Improvising</i>	Composer (ISFP): <i>Synthesizing</i>

Table 2 describes the meaning of each letter with the characteristics of each unique personality.

Table 2 Summary of Individual Components of the Different Personality Types

Letter	Name	Meaning
E	Extraversion	Feel motivated by interaction with people. Tend to enjoy a wide circle of acquaintances, and <i>gain</i> energy in social situations
N	Intuition	More abstract than concrete. Focus attention on the big picture rather than the details, and on future possibilities rather than immediate realities
F	Feeling	Value personal considerations above objective criteria. When making decisions, often give more weight to social implications than to logic
J	Judgment	Plan activities and make decisions early. Derive a sense of control through predictability
I	Introversion	Quiet and reserved. Generally prefer interacting with a few close friends rather than a wide circle of acquaintances, and <i>expend</i> energy in social situations
P	Perception	Withhold judgment and delay important decisions, preferring to "keep their options open" should circumstances change
T	Thinking	Value objective criteria above personal preference. When making decisions, generally give more weight to logic than to social considerations
S	Sensing	More concrete than abstract. Focus attention on the details rather than the big picture, and on immediate realities rather than future possibilities

The results define four main personality types as noted by (Guhya, 2010):

- i. Idealist (NF)
- ii. Rational (NT)
- iii. Guardian (SJ)
- iv. Artisan (SP)

TRENDS PERIODS DURING THE GAME

Panchal (2008) and Chouhan (2009) gave evidence of four different trends in bidding behavior during the period of the game. These trends includes *Learning Trend*, *Discovery Trend*, *Competitive Trends* and *Profit Gain Trend*. Table 3 describes a characteristic trend which has been discovered by Chouhan (2009).

Table 3 Trend Periods and Data as Postulated by Chouhan (2009)

Period Identifier	Description of the Trend Period
A	Learning
B	Discovering
C	Competitive
D	Profit Gain

Figure 1 is a plot of the job number against the job profit in a four bidder's game. Zhou (2012) provided evidence that there were four trend period as mentioned above. The first trend period (Learning period) is from Job 1 to Job 9, in which the new participants tended to keep prices low because of their unfamiliar its with the game rules.

In the second trend period, which is from Job 9 to Job 11, the player started to discover the upper limit of price during the bidding. Usually, they could get a relatively high average rate of return for this period. The third period is from Job 12 to Job 15. During this competitive period, everyone had a better understanding of the game process and they started to compete with other bidders to obtain the jobs. The last period is from Job 16 to Job 37. The participants began to develop their own strategies to gain their profit. It was observed that all the bidders tended to wait for the best available opportunity to enter the game instead of participating from the beginning of the game.

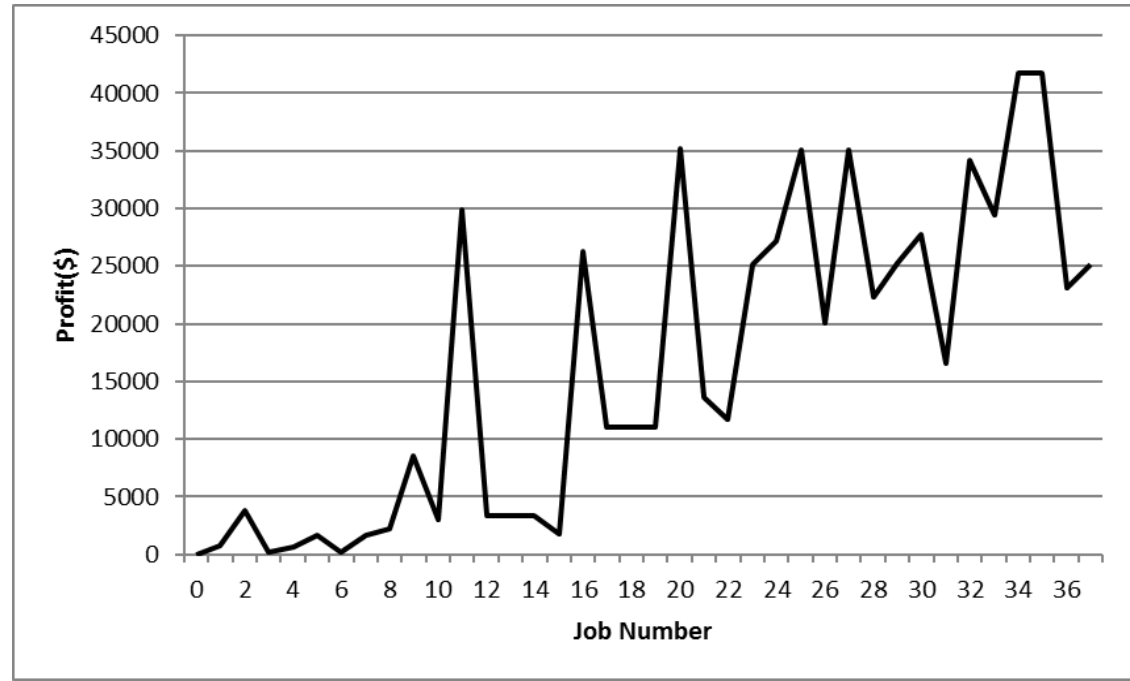


Figure 1 Profit to Different Jobs for Four Bidders (Zhou, 2010)

REVIEW OF THE REVERSE AUCTION GAME

The first Reverse Auction Bidding game was played by van Vleet (2004) without controlling the price. He established the original rules, and used the case study to examine the bidding behaviors and strategies between the bidders and the purchaser. The online RAB system was built by W. Kim (2004), and then redeveloped with SQL Server by Wellington (2006). Guhya (2010) considered this RAB game process as an algorithm, which is shown in Figure 2.

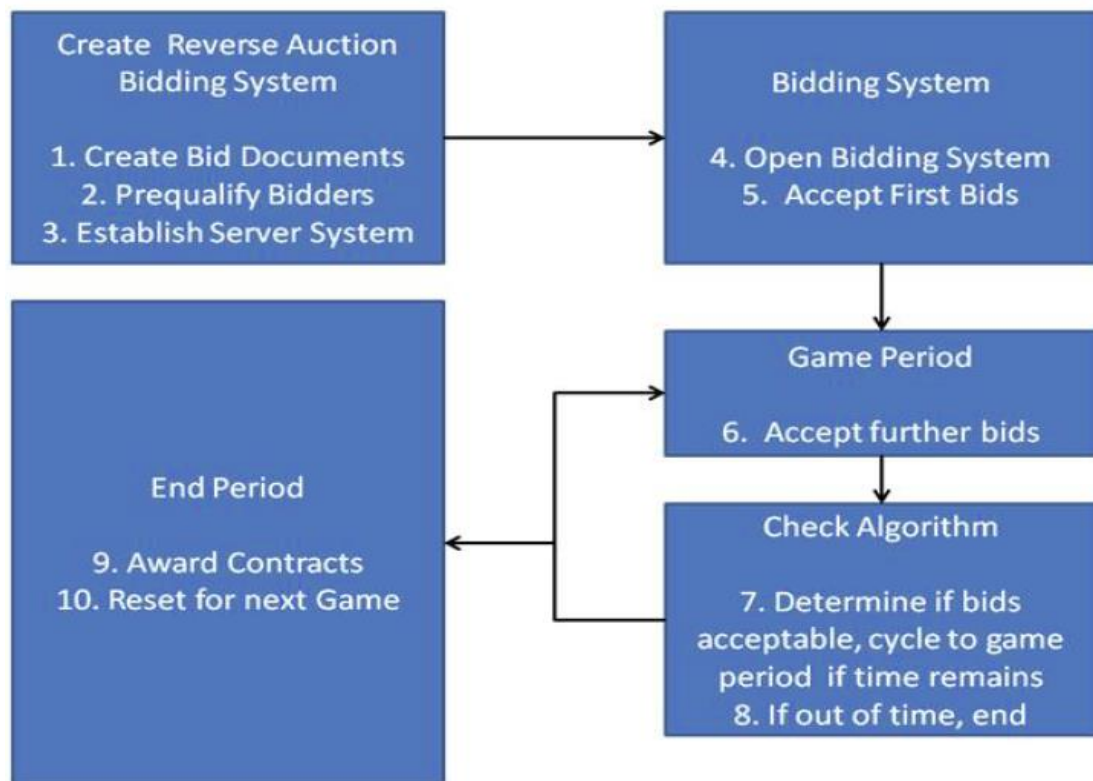


Figure 2 Reverse Auction Bidding General Algorithm

In the game scenario created by van Vleet (2004), each participant acts as an independent contractor working for a production home builder in the Greater Houston area. There are five pre-qualified contractors, and all of them need to bid with each other to get the jobs from this home builder. The works are easy, because the builder build only one type of home requiring the contractor to pour only one type of slab. Five unique login names were given to the participants, and they have their own passwords. Figure 3 is an example of the login page of the website.

Figure 3 The Login Screen for the Game

Site Location

All construction sites are in Houston area, and each job site is assigned a unique site ID. Figure 4 shows the locations for the sites in Houston. Each week the

homebuilder has to start a certain number of homes at one of the six areas that they are building in. A pair of dice are used to decide the number of jobs available in each week, the number of jobs will range from two to twelve in a random set of numbers drawn down from the roll of the dice completed before the game started. In order to make the game more realistic, the construction costs are different for different locations. It is assumed that the purchaser's office is located in Sugarland, TX. Thus, the further the job site from the purchaser's office, the more expensive the travel and delivery costs would be set as a variable in the game.

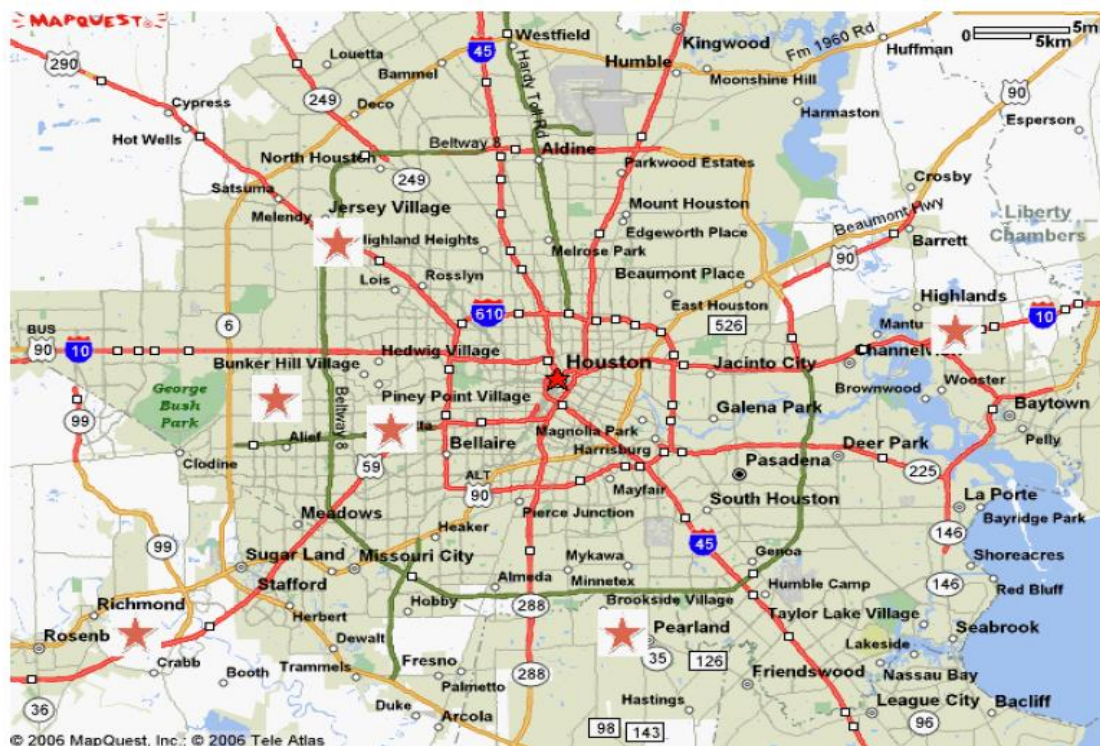


Figure 4 Construction Site Location in Houston (Google Maps, 2004)

Table 4 shows the distance from each site to the main contractor's office in Sugarland and the related construction costs for each site. Those costs were given to the participants along with the base cost of the project.

Table 4 Location of the Construction Site in Houston

Site #	Location of Development	Distance from Sugarland (miles)	Travel Cost (\$)	Delivery Cost (\$)	Total Cost (\$)
Site #1	Brookside Village	42	858	642	1482
Site #2	Piney Point Village	24	495	360	855
Site #3	Highland	7	1452	1056	2508
Site #4	Jersey Village	40	825	600	1425
Site #5	Bunker Hill Village	27	561	408	969
Site #6	Richmond	14	297	216	513

Rain Delay

Rain delay is introduced to the program database. It is assumed that the game was played from May to July, a period which has a relatively high rainfall. Figure 5 depicts the information for the probability of rain in Houston from the National Oceanic and Atmospheric Administration (NOAA, 2012).

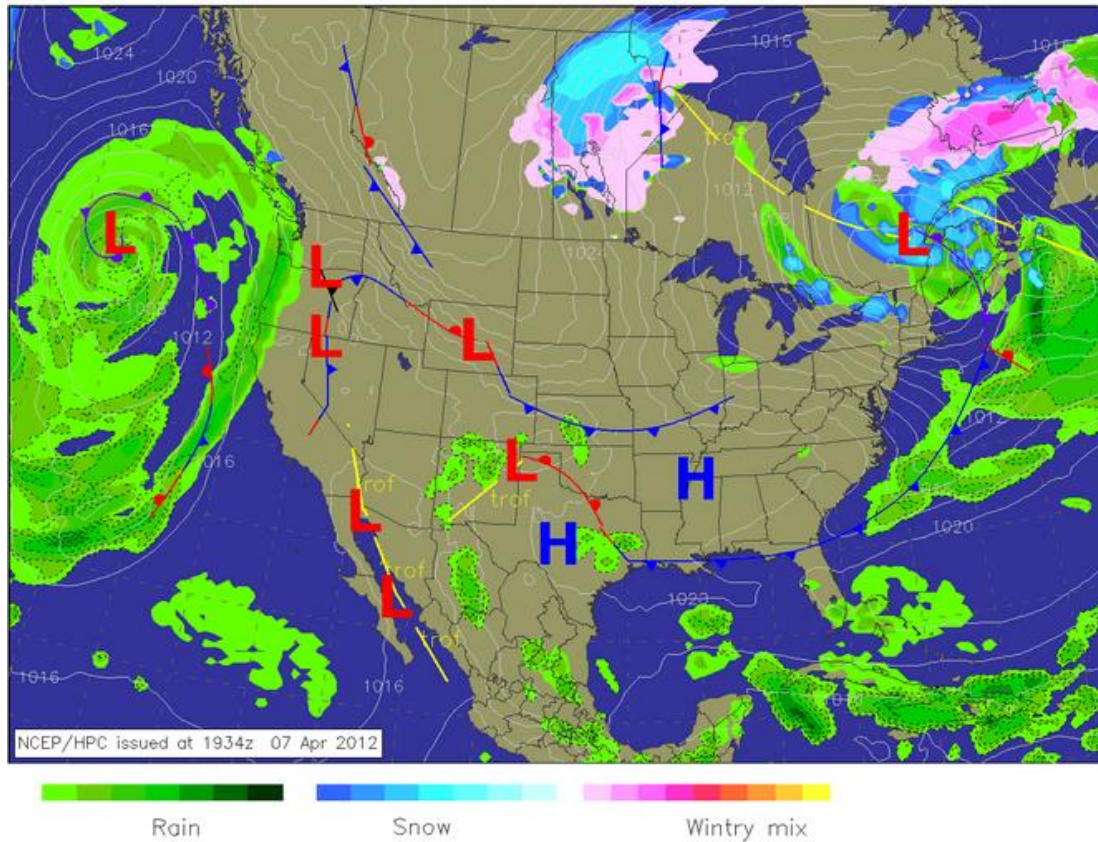


Figure 5 Rain Probability in Houston (after NOAA, 2012)

From the statistical data, the probability of rain in the Houston area from May to July is approximately 30%. That means that there is a 30% chance that the bidders will have a delay in construction on any given day. In order to determine the occurrence of the rain, a random number generator program is used. Table 5 is an example to show the rain delay matrix for a week of the six locations at Houston area. In this table, “0” represents no rainfall and “1” represents enough rainfall to cause a delay in construction. Any kind of rain delay costs the bidder one day of construction for the site, which means that one crew does not work, nor do they get paid.

Table 5 Rain Data for One Week

DAY	Site#					
	Site #1	Site #2	Site #3	Site #4	Site #5	Site #6
Monday	1	0	0	0	1	0
Tuesday	0	1	1	0	0	0
Wednesday	0	0	0	0	0	0
Thursday	0	0	0	0	0	1
Friday	0	0	0	0	1	1
Saturday	0	0	0	0	0	0

The Specifics

1. Each bidder have exactly \$40,000 in his/her account at the beginning of the game.
2. The estimated cost is equal to the base cost (\$10,000) plus travel and delivery fee. Different site locations generate different travel and delivery fee.
3. It is assumed that there are 9 consecutive weeks during the game, and the duration for completed each job is assumed to be five days. The workday start on Tuesday and end on Saturday.
4. All bidders do not know the rain will occur in advance. However, if rain occur then:
 - If is only one day delay in a week, there is no impact on the bidders' ability to bid in the next week.

- If two or more rain delays occur, the bidders will lose one job capacity for the next week.
- The bidders can pay \$500 to get an additional job capacity in the next week.

CHAPTER III

METHODOLOGY

INTRODUCTION

This study tries to introduce an AI Player into the RAB game to bid for the owner. The basic rules and regulations of the game are similar to previous ones, but the investigator will act as the surrogate. The methodology has the following sections:

1. Game Setup
2. Data Collection

GAME SETUP

The basic procedure for the new game is similar to the previous ones:

1. This game are conducted at Langford Building A during a specific time.
2. All the participants will be asked to take the Keirsey Temperament Sorter (KTS) test before they start the game.
3. After the KTS test, the investigator will give a brief introduction about the rules to the participants.
4. Then, a unique login username and password will be assigned to each participant to make sure that they can start their own bidding process on the computer.
5. During the game, the investigator will observe the participants' reaction to the AI Player.

Participants

Three Master students from the Construction Science Department at TAMU are invited to participate in the Reverse Auction Bidding game. These three participants will not be informed that an AI Player will bid with them. The investigator will participate the game and act as if she is one of the bidders. However, the investigator will do nothing except sitting in front of a computer and pretend that she is bidding with others.

Each human participants will be assigned a unique username and password randomly to access the game website, and the company's name assigned to the AI Player is Hammer Company. The other three usernames are:

- i. Driver Co.
- ii. Pliers Co.
- iii. Concrete Co.

In order to gather the personality type information, all participants involved in the game process will be asked to take a KTS test before they start the game. The results are linked to the companies' name.

Site Location and Job Costs

It is assumed that the six construction sites in the Houston area for the new RAB Game were Woodlands, Sugarland, Kingwood, Pecan Grove, Gleanloch Farm and Fairfield. The basic construction costs of these six locations are same (\$ 10,000). However, these different locations generate different delivery costs, due to their different distances from the owner's office as listed in Table 6. The estimated cost can be calculated by the equation below:

$$\text{Estimated Cost} = \text{Delivery Cost} + \text{Basic Cost} + \text{Delivery Cost} * 5 \quad (3)$$

Table 6 Location of the Construction Sites in Houston

Site #	Location	Travel Cost(\$)	Delivery Cost(\$)	Basic Cost(\$)	Estimated Cost(\$)
1	Woodlands	825	700	10,000	14,825
2	Sugarland	500	500	10,000	13,000
3	Kingwood	775	585	10,000	14,460
4	Pecan Grove	600	525	10,000	13,525
5	Gleanloch Farm	700	550	10,000	14,050
6	Fairfield	650	540	10,000	13,790

Game Period and Number of Jobs per Week

The game will last for eight weeks, and each week is represented by a 15-minute game session. Every participant could bid during this single session to get the jobs available in the corresponding week, but they cannot make any change to their bids after the end of the sessions. Between each game session, the participants will have 5 minutes to take a rest. It means that the total game period is 2 hours and 35 minutes.

The number of jobs offered in each session can be shown in Table 7 below. This was governed by the probability of the roll of a pair of dice, as mentioned below. In all, there will be 58 jobs offered to the bidders during the entire course of the game.

Table 7 Number of Job per Week and Descriptive Statistics

Week Number	Job Bid Start		Number of Jobs
	Time	Job Bid End Time	
#1	4:00 PM	4:15 PM	7
#2	4:20 PM	4:35 PM	4
#3	4:40 PM	4:55 PM	5
#4	5:00 PM	5:15 PM	9
#5	5:20 PM	5:35 PM	7
#6	5:40 PM	5:55 PM	11
#7	6:00 PM	6:15 PM	4
#8	6:20 PM	6:35 PM	11

The Introduction of AI Player

The code for the AI Player was written in C# running on the computer and used for this RAB game. The basic rules for the AI Player are described below:

- i. Like other participants, the AI Player has \$40,000 in its bank account at the beginning of the game.
- ii. Also, the AI Player has the capacity to work on 3 jobs per week. However, it cannot take any loan out to finance an additional job. That means, the maximum working capacity of the AI Player is 3 jobs per week.
- iii. The AI Player will bid with the current lowest price for a job within a 2-second time interval.
- iv. It will reduce an integer amount from the current lowest price, this integer is randomly selected from 1 to 200.

- v. The AI Player will bid continuously until the end of the game.
- vi. The AI Player will not bid first on a contract to avoid price fixing.

DATA COLLECTION

The method used for collecting data in this game is common to all previous RAB studies. The key elements are described below.

All related information is available to the bidders once they logged into the website, such as the cost of the job, all current bids and the available time for bidding. Figure 6 is an example of the All Current Bids Screen, which provides information about the locations and estimated costs for all available jobs in a week. In addition, the bidder can learn the current lowest price and who has submitted this price at the same time.

Driver Co.'s RAB - ALL CURRENT BIDS

[\[ALL CURRENT BIDS\]](#) [\[ALL COMPLETED JOBS\]](#) [\[MY BIDS INFO\]](#) [\[LOGOUT\]](#)

Now: Day 64 (Monday), Week: 10

06 1 38 PM

Notices

All Current Bids

JOB#	LOCATION	TRAVEL COST	DELIVERY COST	ESTIMATED COST	CURRENT PRICE	Ept. Profit	Ept. Profit%	BIDDER	Bid Date	MY PRICE	SUBMIT
1683	Highlands	\$ 1452	\$ 1056	\$ 18316	\$ 45700	\$ 27384	59.92%	Driver Co.	Day 57		<input type="button" value="SUBMIT"/>
1684	Richmond	\$ 297	\$ 216	\$ 11701	\$ 40952	\$ 29251	71.43%	Concrete Co.	Day 57		<input type="button" value="SUBMIT"/>
1685	Highlands	\$ 1452	\$ 1056	\$ 18316	\$ 64105	\$ 45789	71.43%	Concrete Co.	Day 57		<input type="button" value="SUBMIT"/>
1686	Brookside	\$ 858	\$ 624	\$ 14914	\$ 52190	\$ 37276	71.42%	Driver Co.	Day 57		<input type="button" value="SUBMIT"/>
1687	Brunker Hill	\$ 561	\$ 408	\$ 13213	\$ 46240	\$ 33027	71.43%	Driver Co.	Day 57		<input type="button" value="SUBMIT"/>
1688	Brunker Hill	\$ 561	\$ 408	\$ 13213	\$ 46240	\$ 33027	71.43%	Driver Co.	Day 57		<input type="button" value="SUBMIT"/>
1689	Piney Point	\$ 495	\$ 360	\$ 12835	\$ 44900	\$ 32065	71.41%	Driver Co.	Day 57		<input type="button" value="SUBMIT"/>
1690	Piney Point	\$ 495	\$ 360	\$ 12835	\$ 44922	\$ 32087	71.43%	Pliers Co.	Day 57		<input type="button" value="SUBMIT"/>
1691	Highlands	\$ 1452	\$ 1056	\$ 18316	\$ 64106	\$ 45790	71.43%	Pliers Co.	Day 57		<input type="button" value="SUBMIT"/>

Figure 6 All Current Bids Screen

As mentioned in the Literature Review part, each bidder can take a loan out to finance an additional job when he or she wants to bid on more than three jobs. The cost of the loan is \$ 500. Figure 7 shows the form provided upon taking out a bank loan.

Notice

- Click the job number or current price of active bids to check the bid history of each jobs.
- Remember your initial job capacity is only 3. You cannot bid anymore if your capacity is over, without taking out a loan at \$500 per site per contract.
- Refresh your browser or click [\[ALL CURRENT BIDS\]](#) button frequently during the bid time to check updated current bid prices.
- * "Ept." means "Expected".
- Bids start on the 10, 30 and 50 minute times for **2106 jobs**. Bidding Time is 15 minutes.
- You have a clock, but remember your clock may be different to the server clock and you need to allow for this fact.
- The tab [\[MY BIDS INFO\]](#) can take 1:30 minutes to refresh. Be warned.

**Currently your capacity is full including current winning bids and jobs in progress.
You cannot bid at this time.**

If you ask for a Bank Guarantee, you can increase your capacity. Bank Guarantee fee is \$500 per guarantee. Do you want?

Figure 7 Bank Guarantee Form

Based on the character of the RAB game, the bidder is only allowed to bid with the current lowest price. Figure 8 will appear as a notification on the screen if the bidder bids an amount higher than the current bid.

Notice

- Click the job number or current price of active bids to check the bid history of each jobs.
- Remember your initial job capacity is only 3. You cannot bid anymore if your capacity is over, without taking out a loan at \$500 per site per contract.
- Refresh your browser or click [\[ALL CURRENT BIDS\]](#) button frequently during the bid time to check updated current bid prices.
- * "Ept." means "Expected".
- Bids start on the 10, 30 and 50 minute times for **2106 jobs**. Bidding Time is 15 minutes.
- You have a clock, but remember your clock may be different to the server clock and you need to allow for this fact.
- The tab [\[MY BIDS INFO\]](#) can take 1:30 minutes to refresh. Be warned.

Your bid amount is higher than current lowest bid amount!!

Don't forget this is a reverse auction !!!!

Check the current bid amount and try again!!!

Figure 8 Higher than Acceptable Bid Screen

The job will be automatically awarded to the lowest bidder at the end of each game session. To see the result of a session, the bidders can go to the My Jobs in Progress Screen (Figure 9) to see the relevant information about the jobs they won. Furthermore, Figure 9 gives an overview of the bidder's financial information, which will help the bidder to decide which bidding strategy he or she will use in the following week.

Driver Co.'s Reverse Auction Bidding - MY BIDS' INFORMATION

[\[ALL CURRENT BIDS\]](#) [\[ALL COMPLETED JOBS\]](#) [\[MY BIDS INFO\]](#) [\[LOGOUT\]](#)

Now: Day 22 (Monday), Week: 4

My Active Bids

JOB#	LOCATION	CURRENT PRICE	CURRENT BIDDER	TIME REMAINING	MY LOWEST BID AMOUNT	OUTBID
14	Woodlands	\$ 100000	Driver Co.	806 seconds.	\$ 100000	
15	Kingwood	\$ 100000	Driver Co.	806 seconds.	\$ 100000	

My Jobs in Progress

JOB#	LOCATION	Bid Amount	Job Start Date	Delays	Construction days	Cost to Date
8	Gleanloch farms	\$ 100000	Day 16	3 days	4 days	\$ 8600
9	Kingwood	\$ 100000	Day 16	3 days	4 days	\$ 8740
10	Sugarland	\$ 100000	Day 16	3 days	4 days	\$ 9200
11	Gleanloch farms	\$ 100000	Day 16	3 days	4 days	\$ 8600

My Completed jobs

Job#	Site	Bid Date	Bid Amount	Cost	Profit	Start day	End day	Rainy days	Profit Rate
5	Woodlands	Day 8	\$ 49999	\$ 11325	\$ 38674	Day 9	Day 15	Day 2	77.35%

My summary

- Current Spare Capacity For Additional Work : 2 [Your total capacity : 6 (Initial capacity : 3, Added capacity by bank guarantee : 3)]
- Current Financial Condition : \$ **41034** (No money paid to initiate work, No money paid in middle of job)
[= Capital money [\$40000] + Profits from completed jobs - Costs of current jobs in progress - Bank Guarantee Fee(\$500/loan)]
Current My Total Bank Guarantee Fee : \$ 2500

Figure 9 Jobs in Progress Screen

Figure 10 is an example of the All Complete Jobs Screen. Whether if the jobs are completed or are still under construction, the bidder can view the status of the jobs they have won.

Concrete Co.'s RAB - ALL COMPLETED JOBS

[\[ALL CURRENT BIDS\]](#) [\[ALL COMPLETED JOBS\]](#) [\[MY BIDS INFO\]](#) [\[LOGOUT\]](#)

Now: Day 71 (Monday), Week: 11

My Completed jobs

Job#	Site	Bid Date	Bid Amount	Cost	Profit	Start day	End day	Rainy days	Profit Rate
1602	Piney Point	Day 8	\$ 13500	\$ 12835	\$ 665	Day 2	Day 7	Day 1	4.93%
1603	Richmond	Day 8	\$ 11850	\$ 11701	\$ 149	Day 2	Day 7	Day 1	1.26%
1604	Richmond	Day 8	\$ 13500	\$ 11701	\$ 1799	Day 2	Day 7	Day 1	13.33%
1605	Brookside	Day 8	\$ 13500	\$ 14914	\$ -1414	Day 2	Day 8	Day 2	-10.47%
1606	Piney Point	Day 8	\$ 16000	\$ 12835	\$ 3165	Day 2	Day 7	Day 1	19.78%
1607	Brunker Hill	Day 8	\$ 17455	\$ 13213	\$ 4242	Day 2	Day 6	Day 0	24.30%
1608	Brookside	Day 8	\$ 17855	\$ 14914	\$ 2941	Day 2	Day 8	Day 2	16.47%
1609	Brunker Hill	Day 8	\$ 15000	\$ 13213	\$ 1787	Day 2	Day 6	Day 0	11.91%
1610	Piney Point	Day 8	\$ 19000	\$ 12835	\$ 6165	Day 2	Day 7	Day 1	32.45%
1611	Richmond	Day 15	\$ 13500	\$ 11701	\$ 1799	Day 9	Day 15	Day 2	13.33%
1612	Piney Point	Day 15	\$ 14000	\$ 12835	\$ 1165	Day 9	Day 14	Day 1	8.32%
1613	Brookside	Day 15	\$ 17900	\$ 14914	\$ 2986	Day 9	Day 16	Day 3	16.68%
1614	Piney Point	Day 15	\$ 15000	\$ 12835	\$ 2165	Day 9	Day 14	Day 1	14.43%
1615	Richmond	Day 15	\$ 12500	\$ 11701	\$ 799	Day 9	Day 15	Day 2	6.39%
1616	Brookside	Day 15	\$ 17425	\$ 14914	\$ 2511	Day 9	Day 16	Day 3	14.41%
1617	Brunker Hill	Day 15	\$ 15000	\$ 13213	\$ 1787	Day 9	Day 16	Day 3	11.91%
1618	Highlands	Day 15	\$ 21000	\$ 18316	\$ 2684	Day 9	Day 15	Day 2	12.78%
1619	Jersey Village	Day 15	\$ 17000	\$ 14725	\$ 2275	Day 9	Day 14	Day 1	13.38%
1620	Highlands	Day 22	\$ 21400	\$ 18316	\$ 3084	Day 16	Day 21	Day 1	14.41%
1621	Jersey Village	Day 22	\$ 17600	\$ 14725	\$ 2875	Day 16	Day 22	Day 2	16.34%

Figure 10 All Completed Jobs Screen

CHAPTER IV

RESULTS

INTRODUCTION

This chapter summarizes the results of the game play, the result include the personality types of the bidder and the result of the interference of the AI Player.

RESULTS OF THE GAME

Table 8 shows the result of the KTS test.

Table 8 Player and Personality Type

User ID	Username	Temperament	Role	Variant Role
	Hammer Co.	AI Player	--	--
2	Driver Co. (ISFJ)	Guardian (Logistical)	Conservator (Supporting)	Protector (Securing)
3	Pliers Co. (INFJ)	Idealist (Diplomatic)	Mentor (Developing)	Counselor (Guiding)
4	Concrete Co. (ESFJ)	Guardian (Logistical)	Conservator (Supporting)	Provider (Supplying)

The Reaction of the Participants during the Game

As mentioned above, the investigator acted as one of the bidders and sat separately with other participants to pretend that she was playing the game. In fact, she

did not control the bidding process at all and the AI Player was playing during the game period except Week #3 and Week #8. User #2 and User #3 sat together, so they could communicate during the game period.

Everything went normally in the first three game sessions. However, User #3 began to realize that User #1 (the AI Player) was abnormal for it was always bidding against him quickly. He started to ask the investigator whether she used a cheating program to play the game, and informed other bidders of his discovery. In the following game sessions, all human bidders began to compete with the AI Player intentionally and tried to drive the AI Player's profits down until they were below zero.

After the game, the investigator interviewed all human bidders and found that all of them believed in the existence of the cheating program because the bid intervals of User #1 (AI Player) were far too short for a real bidder.

Descriptive Statistics of the Bid Data

The total game period consists of eight game sessions, which represent eight weeks. The following Table 9 to Table 16 reveal who is the winner for each job (User ID), the lowest bid amount for this job (Job Price), the total cost of that job (Cost), and the profit the winner can earn from this job. The squares in the tables highlighted the jobs won by the AI Player.

Table 9 First Bid Session

Week	Job ID	Revised ID	Site ID	Job Price (\$)	Cost (\$)	User ID	Profit(\$)
1	12	1	3	31200	14460	2	16740
	13	2	6	31500	13790	2	17710
	14	3	3	39999	14460	3	25539
	15	4	5	39930	14050	1	25880
	16	5	6	39000	13790	3	25210
	17	6	2	17283	13000	1	4283
	18	7	4	28924	13525	1	15399

Table 10 Second Bid Session

Week	Job ID	Revised ID	Site ID	Job Price(\$)	Cost (\$)	User ID	Profit(\$)
2	24	8	3	25000	14460	4	10540
	25	9	6	20929	13790	1	7139
	26	10	3	19833	14460	1	5373
	27	11	2	20839	13000	1	7839

Table 11 Third Bid Session

Week	Job ID	Revised ID	Site ID	Job Price(\$)	Cost (\$)	User ID	Profit(\$)
3	28	12	3	24000	14460	3	9540
	29	13	1	25000	14825	4	10175
	30	14	4	23000	13525	2	9475
	31	15	2	23000	13000	2	10000
	32	16	3	24000	14460	3	9540

Table 12 Fourth Bid Session

Week	Job ID	Revised ID	Site ID	Job Price(\$)	Cost (\$)	User ID	Profit(\$)
4	33	17	4	32000	13525	2	18475
	34	18	6	35000	13790	2	21210
	35	19	5	28000	14050	4	13950
	36	20	2	33000	13000	4	20000
	37	21	1	33000	14825	4	18175
	38	22	3	34500	14460	2	20040
	39	23	3	33964	14460	1	19504
	40	24	5	29841	14050	1	15791
	41	25	1	29977	14825	1	15152

Table 13 Fifth Bid Session

Week	Job ID	Revised ID	Site ID	Job Price(\$)	Cost (\$)	User ID	Profit(\$)
5	42	26	2	12879	13000	1	-121
	43	27	6	13225	13790	1	-565
	44	28	3	13987	14460	1	-473
	45	29	2	17000	13000	4	4000
	46	30	1	18000	14825	2	3175
	47	31	4	17000	13525	2	3475
	48	32	2	17999	13000	3	4999

Table 14 Sixth Bid Session

Week	Job ID	Revised ID	Site ID	Job Price(\$)	Cost (\$)	User ID	Profit(\$)
6	49	33	2	29999	13000	3	16999
	50	34	4	33333	13525	3	19808
	51	35	2	37000	13000	4	24000
	52	36	5	30000	14050	4	15950
	53	37	1	41000	14825	2	26175
	54	38	6	39000	13790	2	25210
	55	39	6	30000	13790	3	16210
	56	40	1	30000	14825	3	15175
	57	41	6	18793	13790	1	5003
	58	42	3	17887	14460	1	3427
	59	43	1	14263	14825	1	-562

Table 15 Seventh Bid Session

Week	Job ID	Revised ID	Site ID	Job Price(\$)	Cost (\$)	User ID	Profit(\$)
7	60	44	4	14000	13525	3	475
	61	45	4	12779	13525	1	-746
	62	46	5	12983	14050	1	-1067
	63	47	6	12745	13790	1	-1045

Table 16 Eighth Bid Session

Week	Job ID	Revised ID	Site ID	Job Price(\$)	Cost (\$)	User ID	Profit(\$)
8	64	48	2	28888	13000	3	15888
	65	49	3	27888	14460	2	13428
	66	50	6	29000	13790	2	15210
	67	51	4	28888	13525	3	15363
	68	52	4	30000	13525	2	16475
	69	53	2	28888	13000	3	15888
	70	54	1	29999	14825	3	15174
	71	55	6	28888	13790	3	15098
	72	56	5	28000	14050	4	13950
	73	57	2	27888	13000	2	14888
	74	58	6	28888	13790	3	15098

ANALYSIS

Bid Efficiency and Profit Efficiency Analysis

The Bid Efficiency and Profit Efficiency are shown in Table 17. According to the Table 17 below, it is clearly shown that the bidding efficiency of User #1, the AI Player is the highest. However, the high winning rate of this player does not translate to the best overall game results should be concerned about the profit. In addition, since the AI Player is on the owner's side and its ultimate goal is to drive down the overall prices to the owner's benefit, the further combined analysis is still necessary.

Table 17 Bid Efficiency and Profit Efficiency

User ID	Company Name	No. of Bid	Jobs Won	Bid Efficiency	Sum of Profit(\$)	Profit Efficiency (\$)
1	Hammer	94	18	19.15%	120,211	6,678
2	Driver	106	15	14.15%	231,686	15,446
3	Pliers	110	16	14.55%	236,004	14,750
4	Concrete	103	9	8.74%	130,740	14,527
Total		413	58		718,641	

The percentage of winning jobs by each individual bidder is shown in Table 17. User #1 (AI Player) won the most of bids in the game.

Figure 11 focus on the Profit Efficiency of each bidder which the data is based on the Table 17. The average amount of total profits made by all participants is \$179,660.

The total profits earned by User #2 (Drive Co.) and User #3 (Pliers Co.) are higher than the average profit, so it can be as “economically effective” bidder. On the contrary, since the total profits earned by User 1 (Hammer Co., the AI Player) and User 4 (Concrete Co.) are lower than the average profit, they are called “economically ineffective” bidders. However, ineffective doesn’t mean making zero profit. Obviously, User #2 has the highest average profit in the whole process of the game.

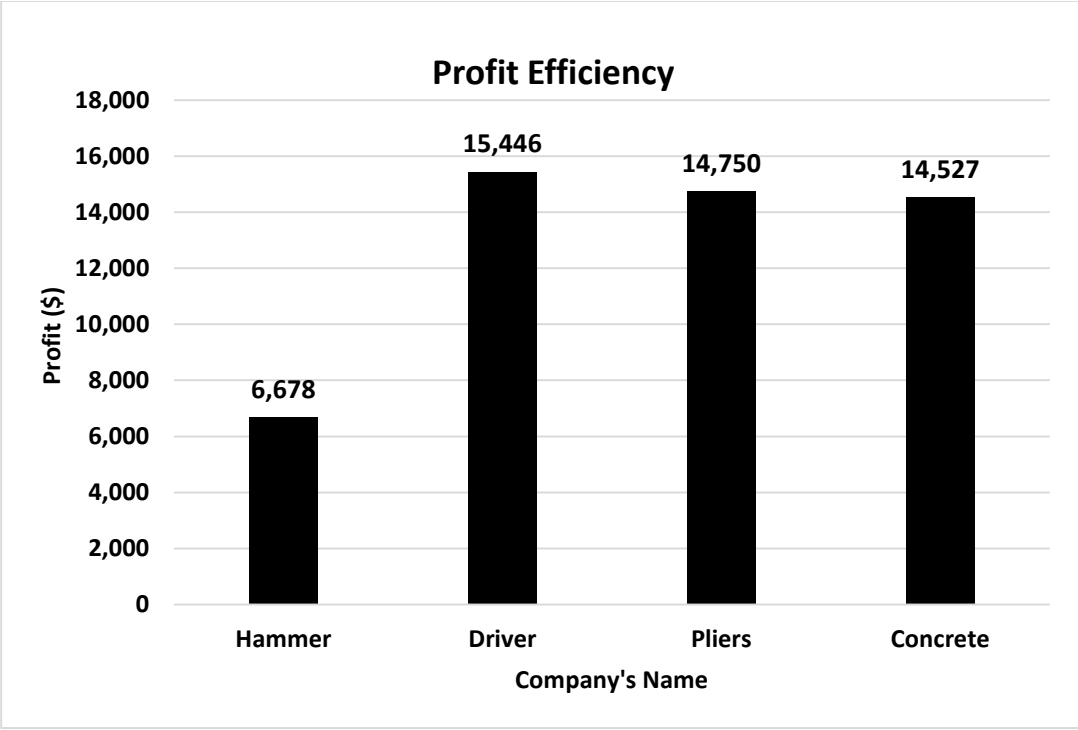


Figure 11 Profit Efficiency

Profit against Job Number Analysis

Total Game Period

From the perspective of job attributives, Figure 12 shows a different trend as the trend described in the Literature Review part. According to the result of the experiment, the profit made by each job fluctuate in a non-orderly fashion. Apparently, the reason of this disorder outcome is the existence of the AI Player. The profit of Job #26, #27, #28, #45, #46, #47, which are awarded to the User #1 (AI Player) are below zero.

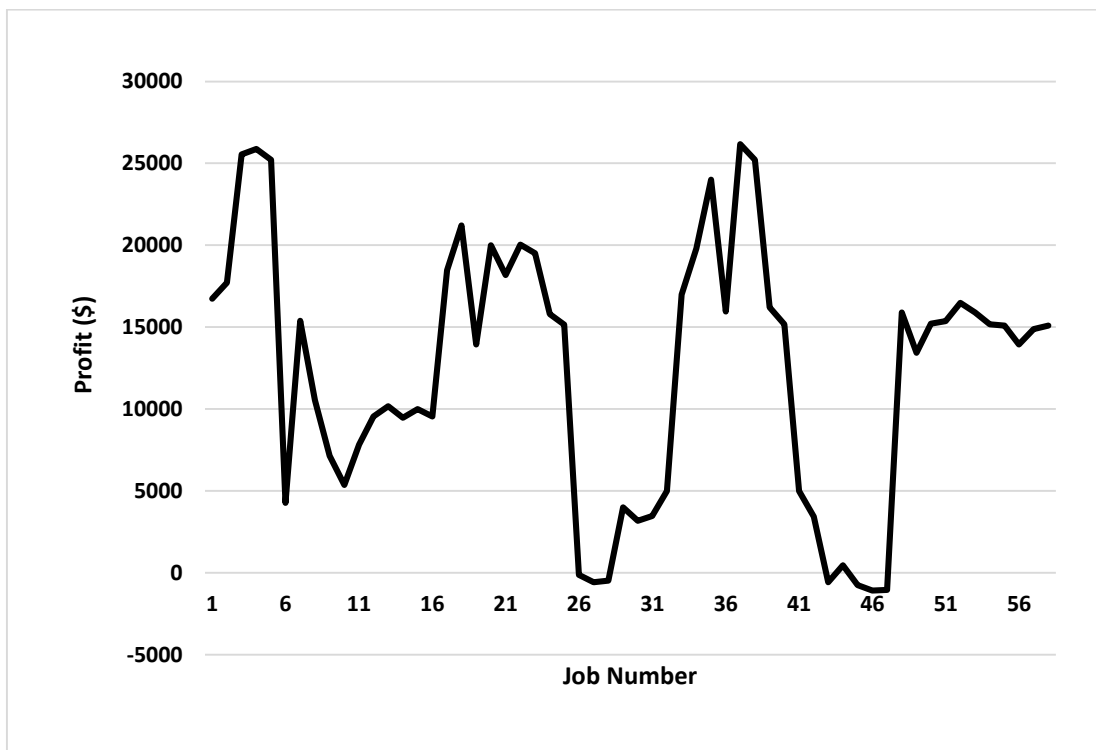


Figure 12 Profit against Job Number in 8 weeks

The data was divided the game period into 3 sections. Since it was a learning period, week #1 has been ignored by the investigator. Section No.1 was consisted of Week #3 and Week #8, which are games without the inference of AI Player. Section No.2 consisted of Week #2, Week #5, and Week #7. While, section No.3 consisted of Week #4 and Week #6.

Table 18 shows the average profit earned in each section. The bidder earns the maximum average profit during Section No.3 and the minimum average profit in Section No. 2.

Table 18 Avg. Profit Earned In each Section

	Week No.	Number of Jobs Available in the week	Avg. Profit Earned in the Week	Total Available Job in these Weeks	Avg. Profit Earned in these Weeks
1	Week #3	5	9,746	16	13,449
	Week #8	11	15,133		
2	Week #2	4	7,723	15	2,867
	Week #5	7	2,027		
	Week #7	4	-196		
	Week #4	9	18,033		
3	Week #6	11	15,218	20	16,485
	Week #4	9	18,033		

Section No. One (without AI Player)

Figure 13 and Figure 14 show the profit earned in Week #3 and Week #8 from each job. The AI Player was absent in these two game sessions and the profit earned is relatively stable and high comparing to the profit of other game sessions.

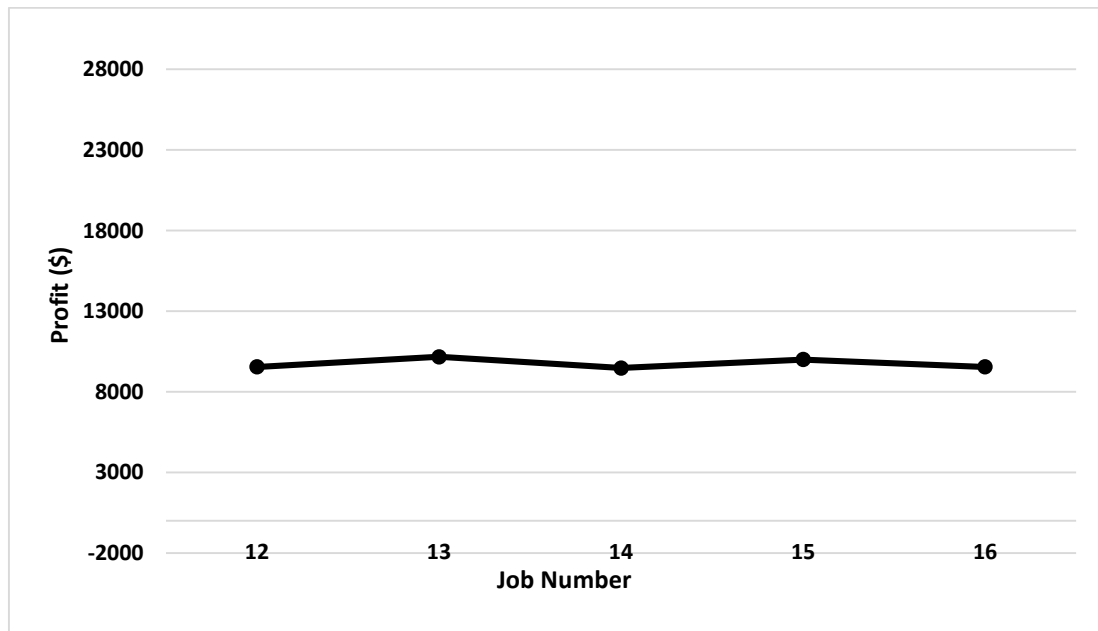


Figure 13 Profit against Job Number in Week #3

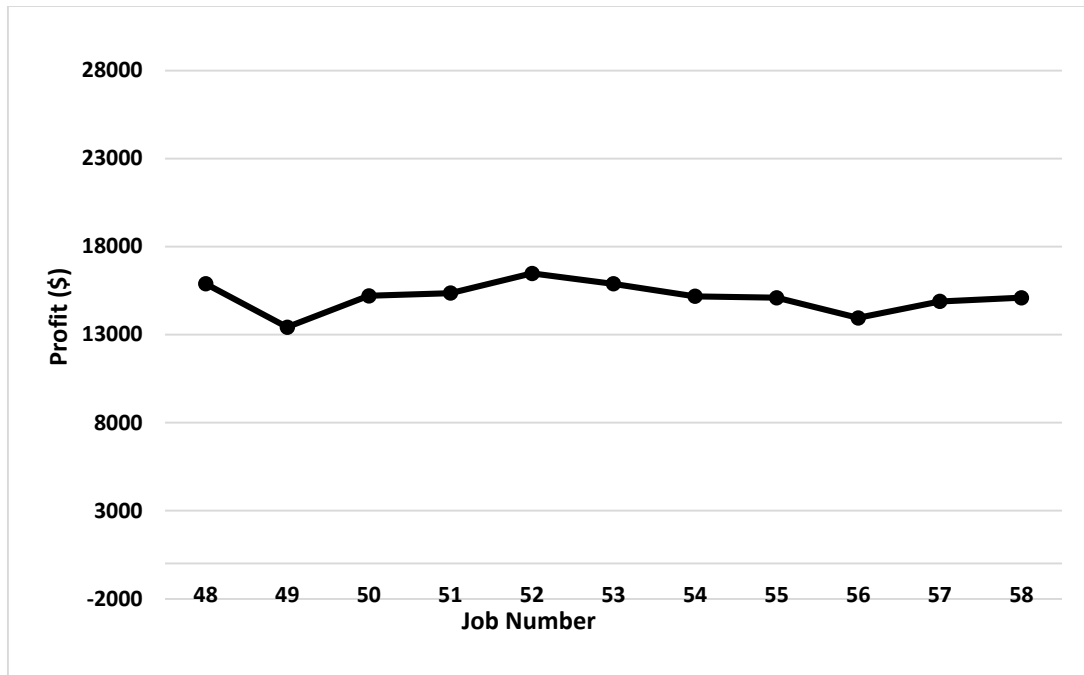


Figure 14 Profit against Job Number in Week #8

Section No. Two

Figure 15, Figure 16 and Figure 17 depict the profit earned in Week #2 Week #5, and Week #7 from each bid. There are only four available jobs in Week #2 and Week #7 and seven available jobs in Week #5. Since the maximum job capacity for each bidder is three jobs per week, four bidders could get totally 12 jobs per week if they did not choose to apply for loan from the bank to get an extra chance to bid. It means that the bidder may act more competitive in this section due to the limited available jobs each week. The overall profits earned in these three sessions are lowest among the three sections. In addition, these three charts show the player who can got the lowest price is always the AI Player.

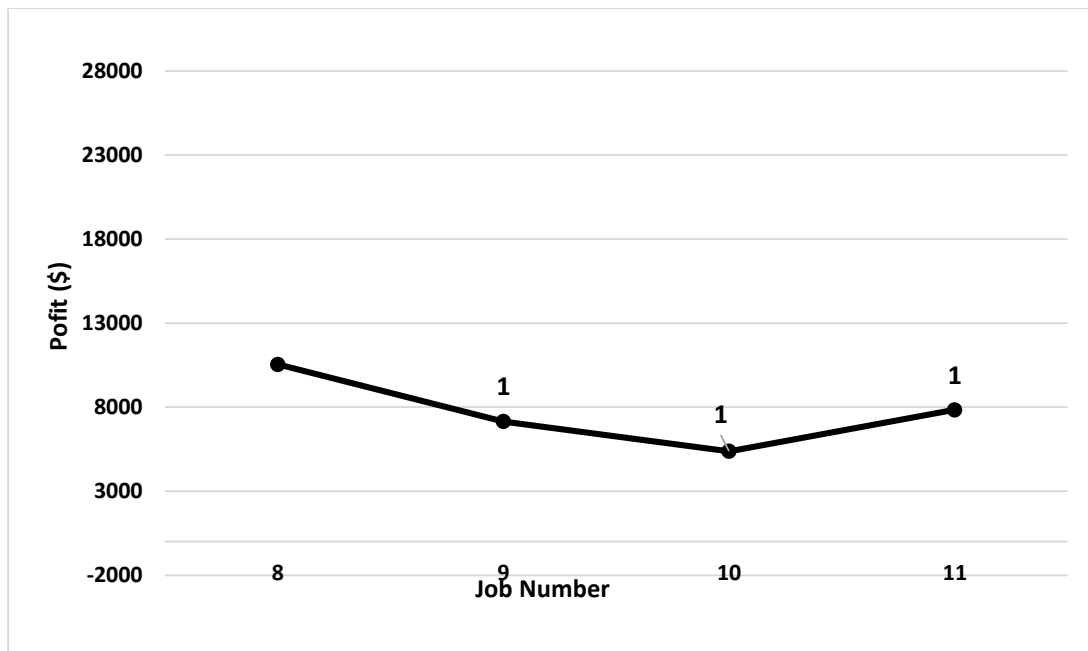


Figure 15 Profit against Job Number in Week #2

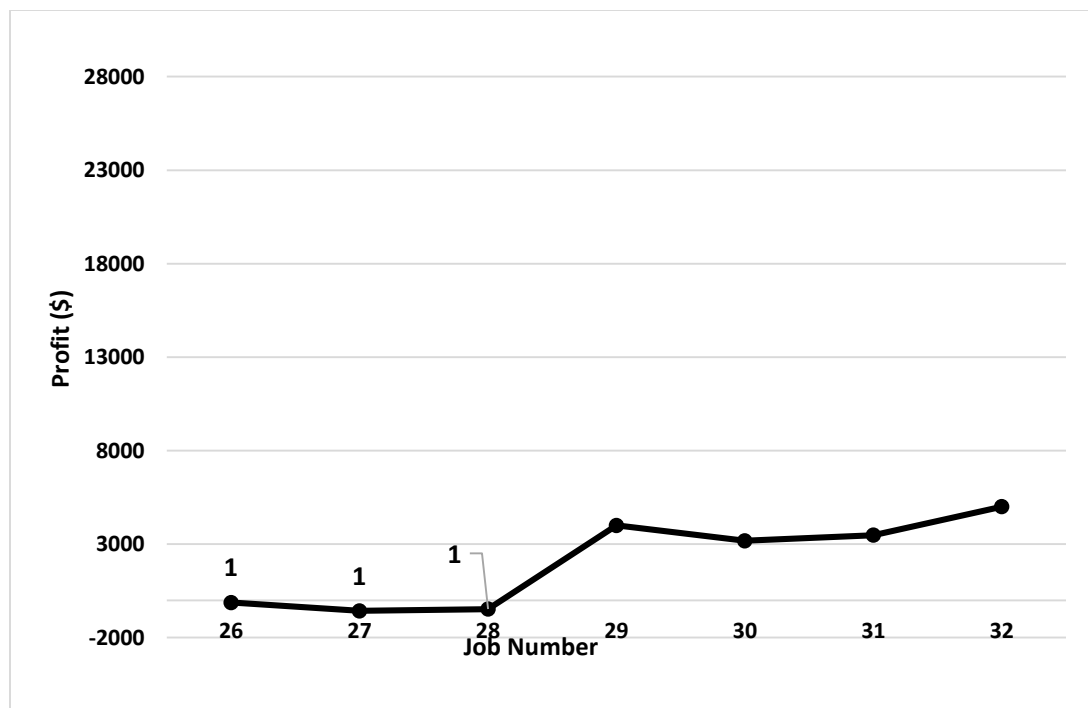


Figure 16 Profit against Job Number in Week #5

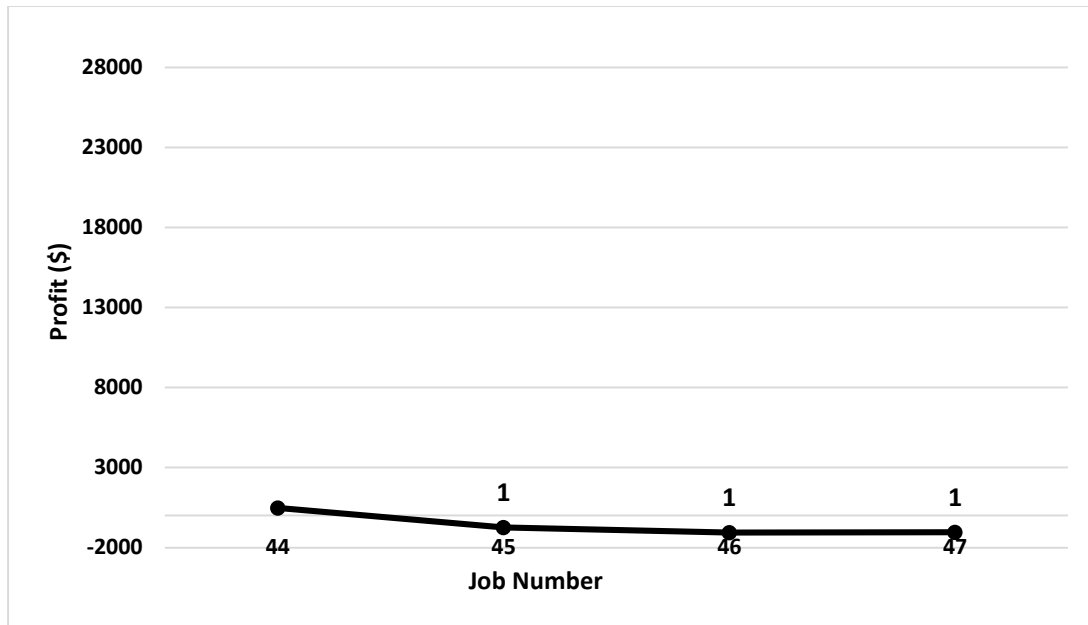


Figure 17 Profit against Job Number in Week #7

Section No. Three

Figure 18 and Figure 19 show the profit earned in Week #4 and Week #6 from each bid. There are nine jobs available in Week #4 and eleven jobs available in Week #6. In other words, the bidders performed less competitive in this section. In addition, the AI Player seems to drag down the profit level.

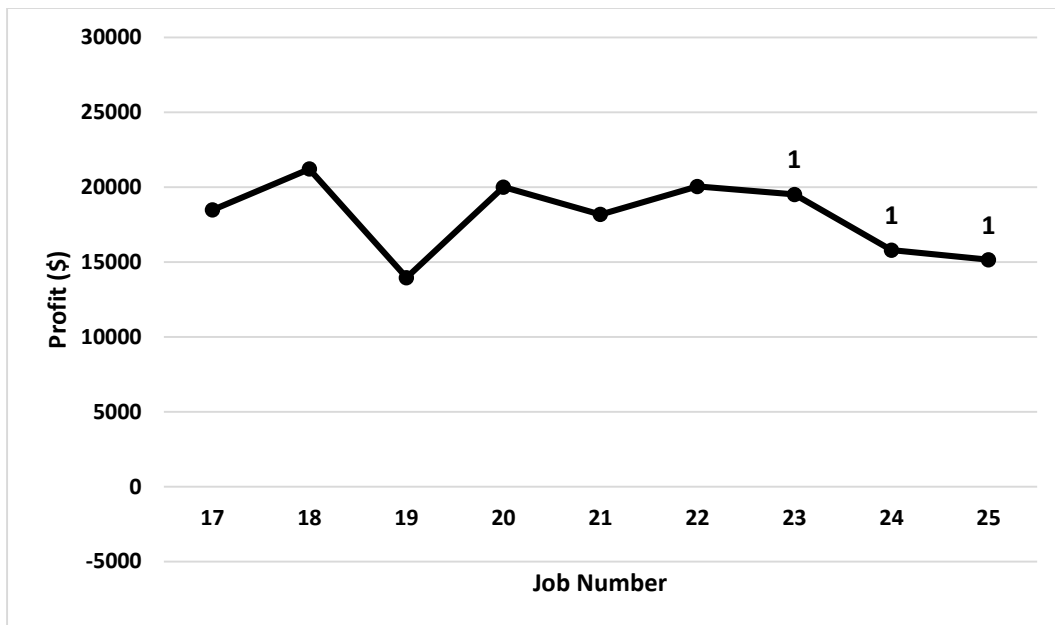


Figure 18 Profit against Job Number in Week #4

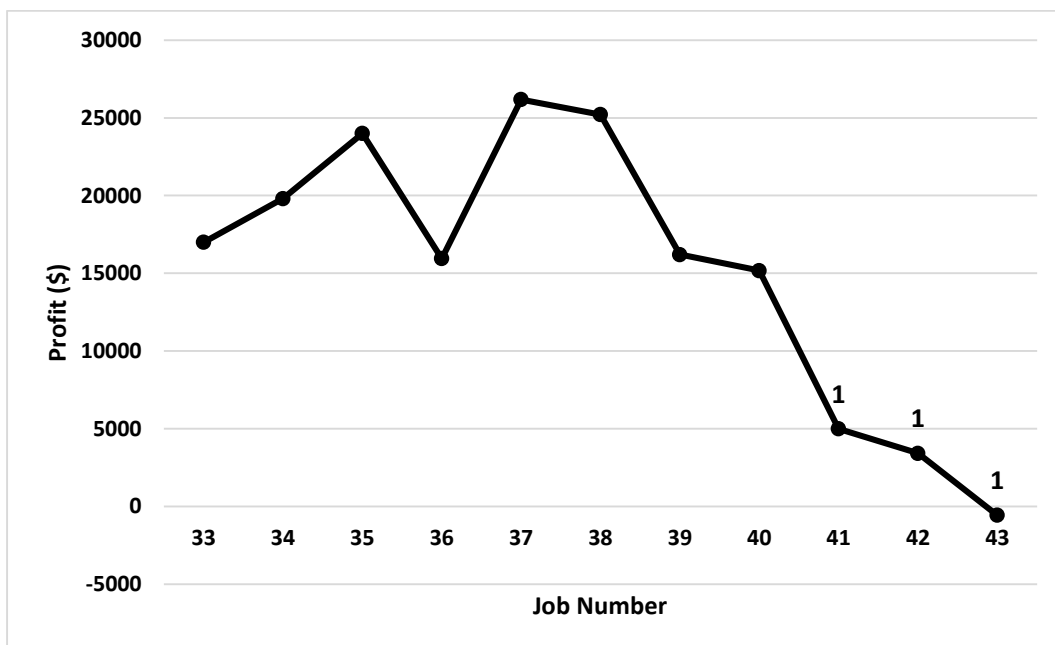


Figure 19 Profit against Job Number in Week #6

The “Death Spiral” in the Game

As mentioned before, the human bidders realized the existence of the AI Player at the end of the fourth week. To react to this “cheating program”, the bidders began to use a strategy, termed a “death spiral” named by Nichols (2015), to lower the AI Player’s profits. By taking this strategy, the bidder’s attention would not focus on what was the estimated cost of a job and how much he or she could earn from it. Instead, the primary goal of the bidder was to drive the profit of the AI Player down below zero. The bids submitted in Job No. 26, Job No. 27 and Job No.29 could illustrate this strategy clearly. The player worked out the AI strategy, and then bid to the strategy to remove the player from the market. Their strategy was efficient and effective.

Figure 20 and Table 19 shows the bids submitted for Job No. 26. User #3 bid the firstly at a price of \$ 29,999. After a 2-second time interval, the AI Player submitted \$ 29,782 as the bid amount. Then, User #2 bid with the AI Player continuously and reduced their bid amounts slowly until the AI Player submitted \$29,192 as a bid amount. From the interview after the game, the investigator learnt that User #2 was realizing that User #1 (the AI Player)’s reactions to his bids during this period were so quick that he could not be human. It made User #2 reduced the bid amount to \$ 20,000 directly, which sloped down the profit line in Figure 20. The AI Player abstracted \$200 from the current lowest price and submitted \$19,800 in a 2-second interval. Finally, User #2’s submission of \$13,000, which was equal to the estimated cost to this job, led the AI Player to submit \$12,880 and get a negative profit from this job. Similar phenomena happened during the

bidding process of Job No. 27 and Job No. 28. These players used to AI strategy against to the AI Player.

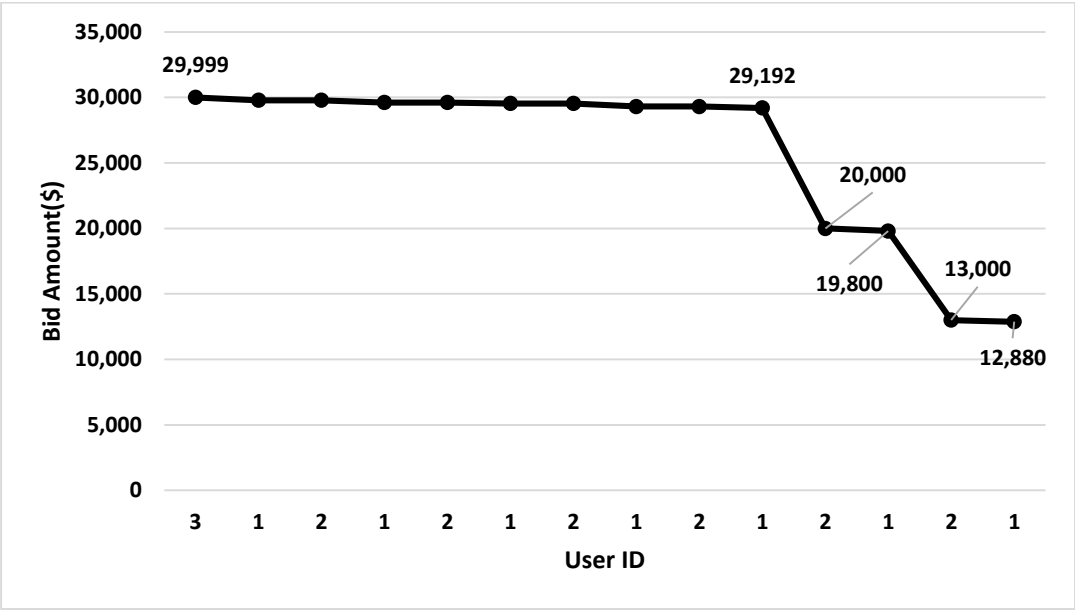


Figure 20 Bids Submitted during Job No. 26

Table 19 Bids Submitted during Job No.26

User ID	Bid Amount(\$)	Bid Time (mm:ss)
3	29,999	21:01.
1	29,782	21:03.
2	29,780	21:57.
1	29,613	22:29.
2	29,610	22:37.
1	29,539	22:39.
2	29,536	22:47.
1	29,307	22:49.
2	29,300	23:25.

Table 19 Continued

User ID	Bid Amount(\$)	Bid Time (mm:ss)
1	29,192	23:26.
2	20,000	23:48.
1	19,800	23:50.
2	13,000	24:01.
1	12,880	24:02.
Estimated Cost (\$)		13,000

Figure 21 and Table 20 shows the bids submitted for Job No. 27.

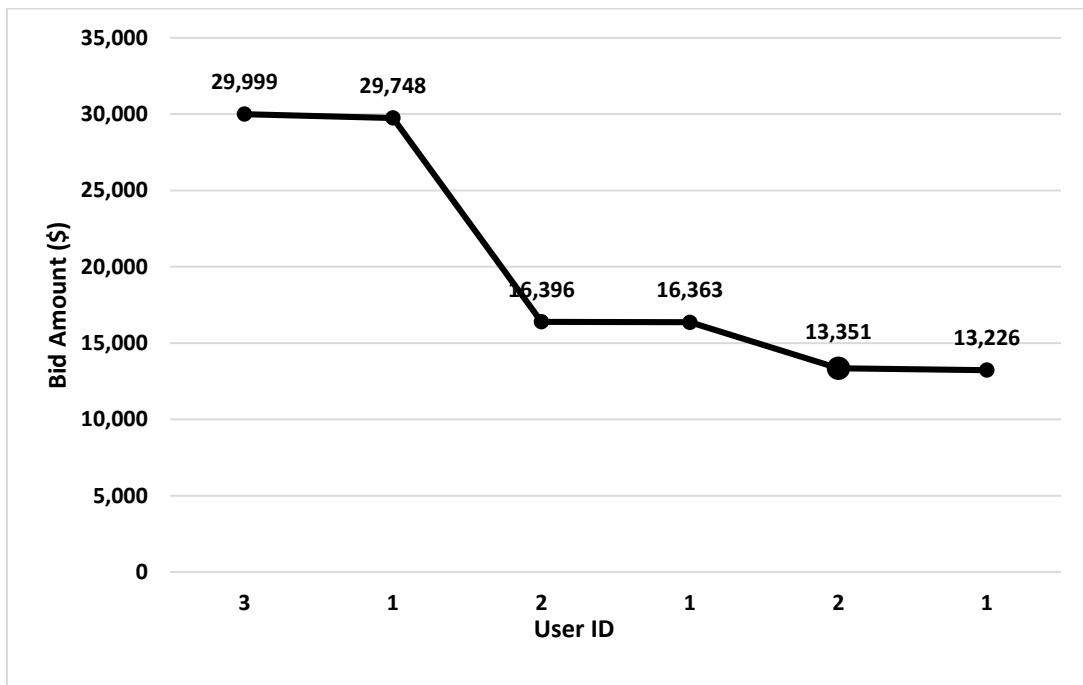


Figure 21 Bid Submitted during Job No.27

Table 20 Bid Submitted during Job No.27

User ID	Bid Amount(\$)	Bid Time(mm:ss)
3	29,999	20:51.
1	29,748	20:53.
2	16,396	23:04.
1	16,363	23:05.
2	13,351	24:45.
1	13,226	24:46.
Estimated Cost (\$)		13,790

Figure 22 and Table 21 shows the bids submitted for Job No. 28.

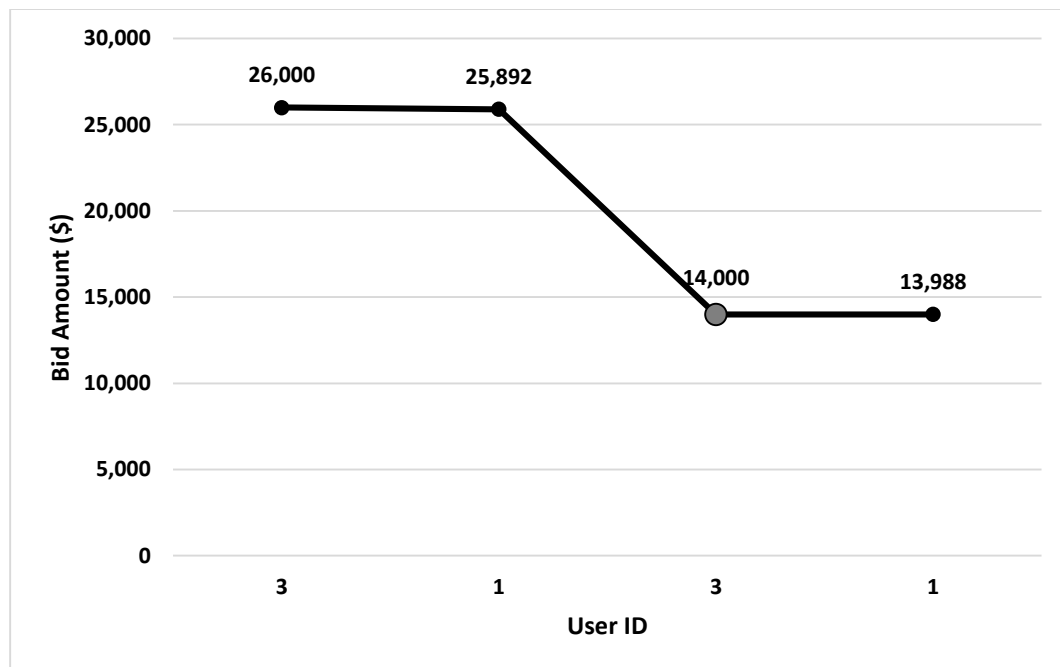


Figure 22 Bids Submitted during Job No. 28

Table 21 Bids Submitted during Job No.28

User ID	Bid Amount(\$)	Bid Time(mm:ss)
3	26,000	25:55.
1	25,892	25:57.
3	14,000	26:05.
1	13,988	26:07.
Estimated Cost (\$)		14,460

Individual Analysis

In this step, the investigator wanted to identify any changes in the participants' bidding strategy over the eight weeks game.

Table 22 and Figure 23 show the bidding data of User #1 (AI Player). The AI Player obtained relatively higher profit level in the first four weeks. However, during the later four weeks, the AI Player obtained a lower at even negative profit. The AI Player's profit was driven down his own profit continuously based on the trend line drawn in Figure 23.

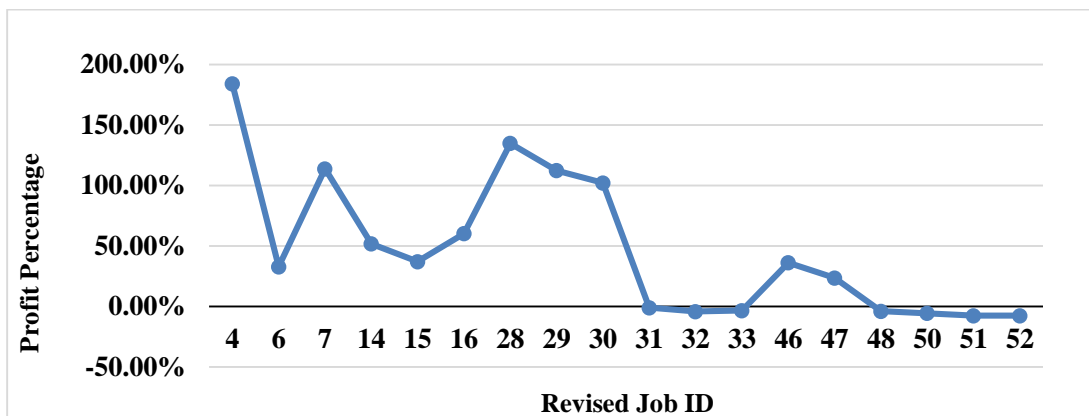
**Figure 23 User #1 (AI Player)'s Profit Percentage History**

Table 22 User #1 (AI Player)'s Bidding Data

Week #	Job ID	Revised ID	Site ID	Job Price (\$)	Cost (\$)	Profit (\$)	Cumulative Profit(\$)	Profit Percentage	Avg Profit
1	15	4	5	39,930	14,050	25,880	25,880	184.20%	47.61%
	17	6	2	17,283	13,000	4,283	30,163	32.95%	
	18	7	4	28,924	13,525	15,399	45,562	113.86%	
2	25	14	6	20,929	13,790	7,139	52,701	51.77%	
	26	15	3	19,833	14,460	5,373	58,074	37.16%	
	27	16	2	20,839	13,000	7,839	65,913	60.30%	
4	39	28	3	33,964	14,460	19,504	85,417	134.88%	
	40	29	5	29,841	14,050	15,791	101,208	112.39%	
	41	30	1	29,977	14,825	15,152	116,360	102.21%	
5	42	31	2	12,879	13,000	-121	116,239	-0.93%	
	43	32	6	13,225	13,790	-565	115,674	-4.10%	
	44	33	3	13,987	14,460	-473	115,201	-3.27%	
6	57	46	6	18,793	13,790	5,003	120,204	36.28%	
	58	47	3	17,887	14,460	3,427	123,631	23.70%	
	59	48	1	14,263	14,825	-562	123,069	-3.79%	
7	61	50	4	12,779	13,525	-746	122,323	-5.52%	
	62	51	5	12,983	14,050	-1,067	121,256	-7.59%	
	63	52	6	12,745	13,790	-1,045	120,211	-7.58%	
Total Profit Earn by User #1 (AI Player)						120,211	856.91%		

Table 23 and Figure 24 show the bidding data of User #2 (Driver Co.). The bidder from Driver Co. obtained relatively higher profit level in the first four weeks and began to earn lower profit in the Week #5.

Table 23 User #2 (Driver Co.)'s Bidding Data

Week #	Revised ID	Site ID	Job Price (\$)	Cost (\$)	Profit (\$)	Cumulative Profit(\$)	Profit Percentage	Avg Profit
1	1	3	31,200	14,460	16,740	16,740	115.77%	111.08%
	2	6	31,500	13,790	17,710	34,450	128.43%	
3	14	4	23,000	13,525	9,475	43,925	70.06%	
	15	2	23,000	13,000	10,000	53,925	76.92%	
4	17	4	32,000	13,525	18,475	72,400	136.60%	
	18	6	35,000	13,790	21,210	93,610	153.81%	
	22	3	34,500	14,460	20,040	113,650	138.59%	
5	30	1	18,000	14,825	3,175	116,825	21.42%	
	31	4	17,000	13,525	3,475	120,300	25.69%	
6	37	1	41,000	14,825	26,175	146,475	176.56%	
	38	6	39,000	13,790	25,210	171,685	182.81%	
8	49	3	27,888	14,460	13,428	185,113	92.86%	
	50	6	29,000	13,790	15,210	200,323	110.30%	
	52	4	30,000	13,525	16,475	216,798	121.81%	
	57	2	27,888	13,000	14,888	231,686	114.52%	
Total Profit Earned by User #2 (Driver Co.)						231,686		

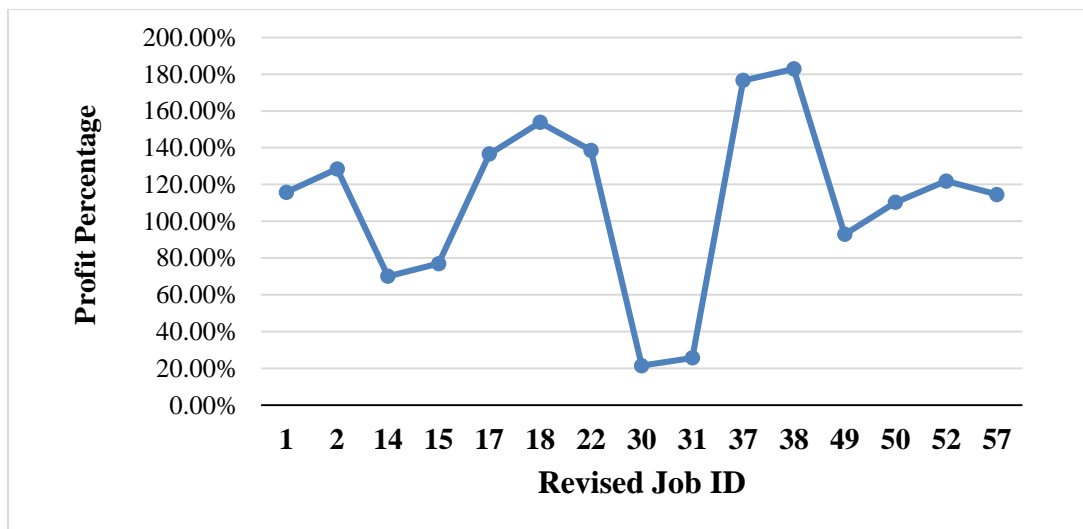


Figure 24 User #2 (Driver Co.)'s Profit Percentage History

Table 24 shows the bidding data of User #3. This bidder got a 949.42% average profit, which is the highest one among all bidders. In addition, Figure 25 shows that User #3 kept a stable trend to earn money through the game period. It should be stated that User #3 is the first person who found out the existing of the cheating program. However, this user has a strong anti-inference ability that he can keep his own strategy in the bidding process although AI Player tries to “mess up” the bidding.

Table 24 User #3 (Pliers Co.)'s Bidding Data

Week #	Revised ID	Site ID	Job Price (\$)	Cost (\$)	Profit (\$)	Cumulative Profit(\$)	Profit Percentage	Avg Profit
1	3	3	39,999	14,460	25,539	25,539	176.62%	949.42%
	5	6	39,000	13,790	25,210	50,749	368.01%	
3	12	3	24,000	14,460	9,540	60,289	416.94%	
	16	3	24,000	14,460	9,540	69,829	482.91%	
5	32	2	17,999	13,000	4,999	74,828	575.60%	
6	33	2	29,999	13,000	16,999	91,827	706.36%	
	34	4	33,333	13,525	19,808	111,635	825.40%	
	39	6	30,000	13,790	16,210	127,845	927.08%	
	40	1	30,000	14,825	15,175	143,020	964.72%	
7	44	4	14,000	13,525	475	143,495	1060.96%	
8	48	2	28,888	13,000	15,888	159,383	1226.02%	
	51	4	28,888	13,525	15,363	174,746	1292.02%	
	53	2	28,888	13,000	15,888	190,634	1466.42%	
	54	1	29,999	14,825	15,174	205,808	1388.25%	
	55	6	28,888	13,790	15,098	220,906	1601.93%	
	58	6	28,888	13,790	15,098	236,004	1711.41%	
Total Profit Earned by User #3 (Pliers Co.)					236,004			

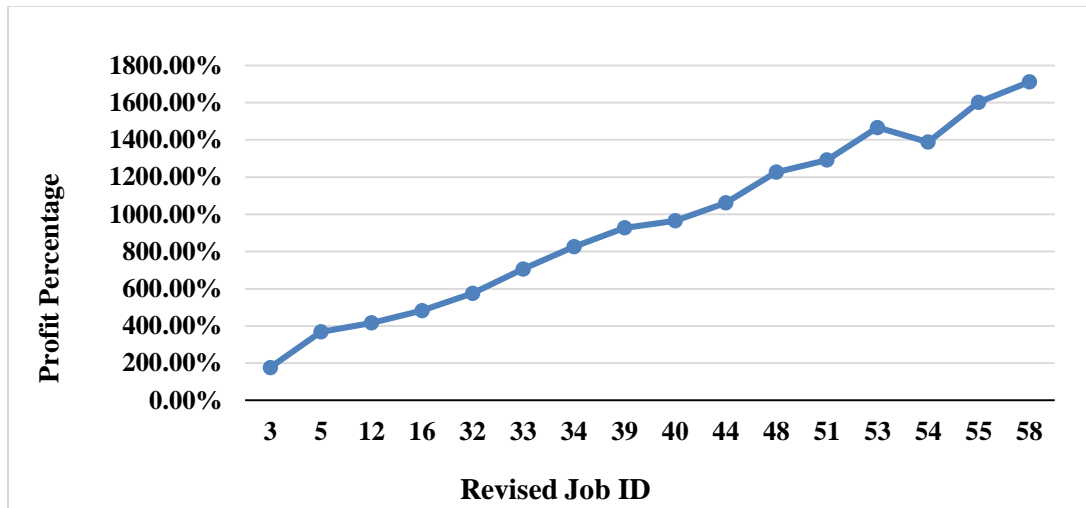


Figure 25 User #3 (Pliers Co.)'s Profit Percentage History

Table 25 and Figure 26 show the bidding data of User #4 (Concrete Co.).

Apparently, User #4 performs similar to User #1. It means that he is also influenced by the AI Player.

Table 25 User #4 (Concrete Co.)'s Bidding Data

Week #	Revised ID	Site ID	Job Price (\$)	Cost (\$)	Profit (\$)	Cumulative Profit(\$)	Profit Percentage	Avg Profit
2	8	3	25,000	14,460	10,540	10,540	72.89%	105.05%
3	13	1	25,000	14,825	10,175	20,715	68.63%	
4	19	5	28,000	14,050	13,950	34,665	99.29%	
	20	2	33,000	13,000	20,000	54,665	153.85%	
	21	1	33,000	14,825	18,175	72,840	122.60%	
5	29	2	17,000	13,000	4,000	76,840	30.77%	
6	35	2	37,000	13,000	24,000	100,840	184.62%	
	36	5	30,000	14,050	15,950	116,790	113.52%	
8	56	5	28,000	14,050	13,950	130,740	99.29%	
Total Profit Earned By User #4 (Concrete Co.)						130,740		

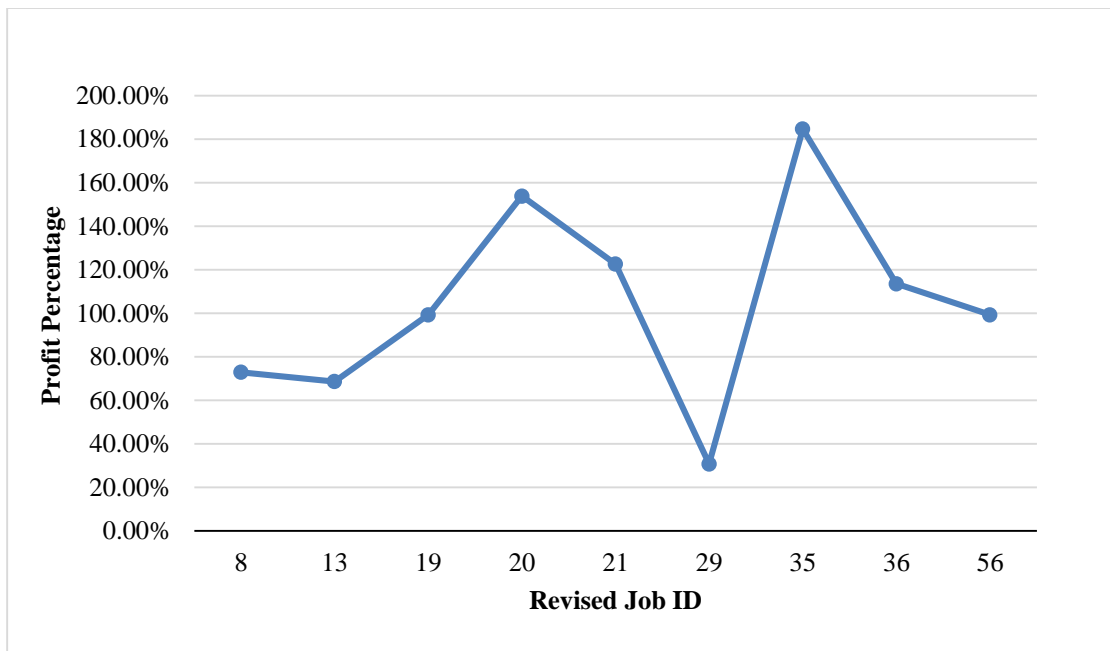


Figure 26 User #4 (Pliers Co.)'s Profit Percentage History

CHAPTER V

CONCLUSION

The study of Reverse Auction Bidding has been undertaken at Texas A&M University since 2004. This research has progressed to new stage of considering the introduction of an AI Player. A previous study proved that a human surrogate from the owner side could interfere with the free market.

An artificially intelligent player provides a research tool to investigate the action of any reaction of the human players to the AI Player. This first study on the AI Player aimed to establish a study a single algorithm for the AI Player. This simple strategy adopted for the AI Player was a two seconds delay on bids from a human bid, bid on the current highest bid and do not bid more than three jobs. This strategy proved too simple in the long run. The pattern became evident to the other players who ceased bidding all but three jobs until the AI Player has a loss and then resumed competition play. It is recommended that a rule be adopted to allow the AI Player to start bidding.

The time interval used for the AI Player in this research is 2 seconds, which proved to be too short. In addition, the human bidders detected the AI Player because it reacted to the current lowest bid constantly with the same time interval. After the human bidders detected the AI Player, they started to use a strategy named “death spiral” to drive the profit of the AI Player down below to zero. This phenomena ensured them the existing of the AI Player. So, a lower limit for the bid prices submitted by the AI Player should be set in the future.

Experiments with AI Player, which has random time intervals and a lower limit on the bidding price, are needed in the future.

REFERENCES

- Chaudhari, S. (2009). *Owner's interference in Reverse Auction Bidding to skew a free market*. (Construction Management) (Master's Thesis), Texas A&M University, College Station.
- Chouhan, M. (2009). *Bidder's personality and its significance*. (Construction Management) (Master's Thesis), Texas A&M University, College Station.
- Guhya, D. (2010). *Reverse Auction Bidding: A statisitcal review of the first case study*. (Construction Management) (Master's Thesis), Texas A&M University, College Station.
- Hatipkarasulu, Y., & Gill Jr, J. H. (2004). Identification of shareholder ethics and responsibilities in online reverse auctions for construction projects. *Science and Engineering Ethics*, 10(2), 283-288.
- Hawkins, T., Coyne, A., & Hudgens, B. (2009). Electronic reverse auctions: Removing barriers to unleash savings in federal procurement. *Air Force Journal of Logistics*, 34(3), 2-15.
- Horlen, J., Eldin, N., & Ajinkya, Y. (2005). Reverse Auctions: Controversial Bidding Practice. *Journal of Professional Issues in Engineering Education and Practice*, 131(1), 76-81. doi:10.1061/(ASCE)1052-3928(2005)131:1(76)

- Joo, Y., & Kim, Y. (2004). Determinants of corporate adoption of e-marketplace: An innovation theory perspective. *Journal of Purchasing and Supply Management*, 10(2), 89-101.
- Kleijnen, J. (2011). Sealed-bid auction of Netherlands mussels: Statistical analysis. *International Journal of Production Economics*, 132(1), 154-161.
doi:10.1016/j.ijpe.2011.03.026
- Mabert, V. A., & Skeels, J. A. (2002). Internet reverse auctions: Valuable tool in experienced hands. *Business Horizons*, 45(4), 70-76.
- Manoochehri, G., & Lindsay, C. (2008). Reverse auctions: Benefits, challenges, and best practices. *California Journal of Operations Management*, 6(1), 123-130.
- Nichols, B. S., & Flint, D. J. (2010). Consumer competitiveness and need for control: A study of internet auction bidding. *International Journal of Electronic Marketing and Retailing*, 3(3), 261-292.
- Panchal, N. (2007). *Reverse auction bidding: Case study*. (Construction Management) (Master's Thesis), Texas A&M University, College Station.
- Ray, A. K., Jenamani, M., & Mohapatra, P. K. (2010). Bidding decision in multi-attribute reverse auction. *International Journal of Applied Decision Sciences*, 3(3), 280-295.

- Schoenherr, T. (2008). The use of bundling in B2B online reverse auctions. *Journal of Operations Management*, 26(1), 81-95. doi:10.1016/j.jom.2007.05.001
- Srinath, T., Kella, S., & Jenamani, M. (2011). A new secure protocol for multi-attribute multi-round E-reverse auction using online trusted third party. Paper presented at the *Emerging Applications of Information Technology (EAIT), 2011 Second International Conference on*, 149-152.
- Srinath, S., Kella, M., & Jenamani, M. (2011). *A new secure protocol for multi-attribute multi-round e-reverse auction using online trusted third party*
doi:10.1109/EAIT.2011.83
- Van Vleet II, R. G. (2004). *Reverse auction bidding: An analysis of a case study*. (Construction Management) (Master's Thesis), Texas A&M University, College Station.
- Wamuziri, S., & Abu-Shaaban, N. (2005). *Potential of reverse auctions in construction procurement*. Paper presented at the 21st Annual ARCOM Conference.
- Yuan, S. (2013). *Reverse Auction Bidding - Time Series Analysis*. (Construction Management) (Master's Thesis), Texas A&M University, College Station.
- Yuan, Y. (2012). A multi-attribute reverse auction decision making model based on linear programming. *Systems Engineering Procedia*, 4, 372-378.

APPENDIX A

THE KEIRSEY TEMPERAMENT SORTER

TEST

For each question, decide on answer a or b and put a check mark in the proper column of the answer sheet. Scoring directions are provided. There is no right or wrong answers since about half the population agrees with whatever answer you choose.

1. When the phone rings do you
 - a. hurry to get to it first
 - b. hope someone will answer
2. Are you more
 - a. observant than introspective
 - b. introspective than observant
3. Is it worse to
 - a. have your head in the clouds
 - b. be in a rut
4. With people are you usually more
 - a. firm than gentle
 - b. gentle than firm
5. Are you more comfortable in making
 - a. critical judgments
 - b. value judgments
6. Is clutter in the workplace something you
 - a. take time to straighten up
 - b. tolerate pretty well
7. Is it your way to
 - a. make up your mind quickly
 - b. pick and choose at some length
8. Waiting in line, do you often
 - a. chat with others
 - b. stick to business
9. Are you more
 - a. sensible than ideational
 - b. ideational than sensible
10. Are you more interested in
 - a. what is actual
 - b. what is possible
11. In making up your mind are you more likely

- a. to go by data
- b. to go by desires
- 12. In sizing up others do you tend to be
 - a. objective and impersonal
 - b. friendly and personal
- 13. Do you prefer contracts to be
 - a. signed, sealed, and delivered
 - b. settled on a handshake
- 14. Are you more satisfied having
 - a. a finished product
 - b. work in progress
- 15. At a party, do you
 - a. interact with many, even strangers
 - b. interact with a few friends
- 16. Do you tend to be more
 - a. factual than speculative
 - b. speculative than factual
- 17. Do you like writers who
 - a. say what they mean
 - b. use metaphors and symbolism
- 18. Which appeals to you more:
 - a. consistency of thought
 - b. harmonious relationships
- 19. If you must disappoint someone are you
 - a. usually frank and straightforward
 - b. warm and considerate
- 20. On the job do you want your activities
 - a. scheduled
 - b. unscheduled
- 21. Do you more often prefer
 - a. final, unalterable statements
 - b. tentative, preliminary statements
- 22. Does interacting with strangers
 - a. energize you
 - b. tax your reserves
- 23. Facts
 - a. speak for themselves
 - b. illustrate principles
- 24. Do you find visionaries and theorists
 - a. somewhat annoying
 - b. rather fascinating
- 25. In a heated discussion, do you

- a. stick to your guns
- b. look for common ground
- 26. Is it better to be
 - a. Just
 - b. merciful
- 27. At work, is it more natural for you to
 - a. point out mistakes
 - b. try to please others
- 28. Are you more comfortable
 - a. after a decision
 - b. before a decision
- 29. Do you tend to
 - a. say right out what's on your mind
 - b. keep your ears open
- 30. Common sense is
 - a. usually reliable
 - b. frequently questionable
- 31. Children often do not
 - a. make themselves useful enough
 - b. exercise their fantasy enough
- 32. When in charge of others do you tend to be
 - a. firm and unbending
 - b. forgiving and lenient
- 33. Are you more often
 - a. a cool-headed person
 - b. a warm-hearted person
- 34. Are you prone to
 - a. nailing things down
 - b. exploring the possibilities
- 35. In most situations are you more
 - a. deliberate than spontaneous
 - b. spontaneous than deliberate
- 36. Do you think of yourself as
 - a. an outgoing person
 - b. a private person
- 37. Are you more frequently
 - a. a practical sort of person
 - b. a fanciful sort of person
- 38. Do you speak more in
 - a. particulars than generalities
 - b. generalities than particular
- 39. Which is more of a compliment:
 - a. "There's a logical person"

- b. "There's a sentimental person"
- 40. Which rules you more
 - a. your thoughts
 - b. your feelings
- 41. When finishing a job, do you like to
 - a. tie up all the loose ends
 - b. move on to something else
- 42. Do you prefer to work
 - a. to deadlines
 - b. just whenever
- 43. Are you the kind of person who
 - a. is rather talkative
 - b. doesn't miss much
- 44. Are you inclined to take what is said
 - a. more literally
 - b. more figuratively
- 45. Do you more often see
 - a. what's right in front of you
 - b. what can only be imagined
- 46. Is it worse to be
 - a. softy
 - b. hard-nosed
- 47. In trying circumstances are you sometimes
 - a. too unsympathetic
 - b. too sympathetic
- 48. Do you tend to choose
 - a. rather carefully
 - b. somewhat impulsively
- 49. Are you inclined to be more
 - a. hurried than leisurely
 - b. leisurely than hurried
- 50. At work do you tend to
 - a. be sociable with your colleagues
 - b. keep more to yourself
- 51. Are you more likely to trust
 - a. your experiences
 - b. your conceptions
- 52. Are you more inclined to feel
 - a. down to earth
 - b. somewhat removed
- 53. Do you think of yourself as a
 - a. tough-minded person
 - b. tender-hearted person

54. Do you value in yourself more that you are
 - a. reasonable
 - b. devoted
55. Do you usually want things
 - a. settled and decided
 - b. just penciled in
56. Would you say you are more
 - a. serious and determined
 - b. easy going
57. Do you consider yourself
 - a. a good conversationalist
 - b. a good listener
58. Do you prize in yourself
 - a. a strong hold on reality
 - b. a vivid imagination
59. Are you drawn more to
 - a. fundamentals
 - b. overtones
60. Which seems the greater fault
 - a. to be too compassionate
 - b. to be too dispassionate
61. Are you swayed more by
 - a. convincing evidence
 - b. a touching appeal
62. Do you feel better about
 - a. coming to closure
 - b. keeping your options open
63. Is it preferable mostly to
 - a. make sure things are arranged
 - b. just let things happen naturally
64. Are you inclined to be
 - a. easy to approach
 - b. somewhat reserved
65. In stories do you prefer
 - a. action and adventure
 - b. fantasy and heroism
66. Is it easier for you to
 - a. put others to good use
 - b. identify with others
67. Which do you wish more for yourself:
 - a. strength of will
 - b. strength of emotion
68. Do you see yourself as basically

- a. thick-skinned
 - b. thin-skinned
69. Do you tend to notice
- a. disorderliness
 - b. opportunities for change
70. Are you more
- a. routinized than whimsical
 - b. whimsical than routinized

APPENDIX B

KIERSEY TEMPERAMENT SORTER SCORING

TEST SAMPLE SHEET

Enter a check for each answer in the column for a or b.

[illegible]

DIRECTIONS FOR SCORING

1. **Add down** so that the total number of a answers is written in the box at the bottom of each column. Do the same for the b answers you have checked. Each of the 14 boxes should have a number in it.
2. **Transfer the number** in box #1 of the answer grid to box #1 below the answer grid. Do this for box # 2 as well. Note, however, that you have two numbers for boxes 3 through 8. Bring down the first number for each box beneath the second, as indicated by the arrows. Now add all the pairs of numbers and enter the total in the boxes below the answer grid, so each box has only one number.
3. **Now you have** four pairs of numbers. Circle the letter below the larger numbers of each pair. If the two numbers of any pair are equal, then circle neither, but put a large X below them and circle it.

APPENDIX C

ASP PROGRAM

INTRODUCTION

This Active Server Pages (ASP) Program was written by Professor John Nichols and used for the RAB game.

A.1 INDEX.ASP

```
<!--  
-----  
    Programmers:  
    Original Code Yong Kim 2004  
        New Code John Nichols 2008  
        Revised Code John Nichols 2012  
    Revised Code John Nichols 2015  
-----  
    Comments:  
    The program starts from a call to >> index.asp.  
    Index.asp calls >> db_open.asp  
    which returns the connection string.  
    Index.asp then puts up the titles and opens the style.css sheet.  
  
-->  
  
<!--#include file="db_open.asp"-->  
<html>  
<head>  
<title>Reverse Auction Bidding - Login</title>  
<link rel="stylesheet" href="style.css">  
</head>  
<!--#include file="daysetting.asp"-->  
<BODY oncontextmenu="return false" >  
<div align="center">  
    <center>  
        <table width="90%" cellpadding="0" cellspacing="0" height="100%" >  
            <tr>
```

```

<td valign="top"><TABLE width="100%">
  <TR>
    <TD><H1 >Reverse Auction Bidding Game </H1></TD>
    <TD><H2 align="right" >Login to the Game</H2></TD>
  </TR>
</TABLE>
<TABLE width="100%">
  <TR>
    <!--Place the current time and date information on the main login screen. -->
    <TD><H4 >Now: Day<%=now_date%> (<%=now_day%>),
Week:<%=recursive_week%> </H4></TD>
    <TD align="right"><iframe scrolling="no" frameborder="0"
style="overflow:hidden;border:0;margin:0;padding:0;width:120px;height:40px;"
src="http://www.clocklink.com/html5embed.php?clock=004&timezone=CST&color=pi
nk&size=120"></iframe></TD>
    <%
      set rsWeather = nothing
      set rsContractor = nothing
    %>
  </TR>
  <tr>
    <td><!-- Recursive Date Difference -->
      <fieldset >
        <legend >
          <H4>Time Details</H4>
        </legend>
        <p>Current Start Date: <%=FormatDateTime(start_time, vbLongDate)%>
<br>
      <br>
      <br>
    </p>
    </fieldset>
    <!--<a href="changestarttime.asp" name="style.css" target="_blank"
class="table">edit</a>--></td>
  </tr>
</TABLE>
<BR>
<fieldset>
<legend>
<H4>Notice</H4>
</legend>
<table border="0" cellpadding="15" cellspacing="0" style="border-collapse:
collapse" bordercolor="#111111" width="95%" id="AutoNumber1" >

```

```

        <tr>
        <td width="100%" valign="top"><% if DateDiff("s",start_time, now) < 0
then%>
        <p class="p">The Game will start at <%=start_time%>. See you soon - Good
luck.<br>
        </p>
        <%end if%>
        <p class="p"> <br><br>
        This site is designed to undertake research into Game Theory for Reverse
Auction Bidding.<br><br>
        Investigator, Mengya Zeng(<a
href="mailto:zengmengya@tamu.edu">zengmengya@tamu.edu</a>), Graduate Student
in the Department of Construction Science</p>
        <br><br></td>
        </tr>
    </table>
</fieldset>
<br>
<form action="login_check.asp" method="post">
    <fieldset>
    <legend>
    <h4>Login</h4>
    </legend>
    <table border="0" cellpadding="0" cellspacing="0" width="95%"
id="AutoNumber1" height="50">
    <tr>
        <td align="right"><b>User Name:</b></td>
        <td><input type="text" name="usrLogID" size="20"></td>
        <td align="right"><b>Password:</b></td>
        <td><input type="password" name="usrPassword" size="20"></td>
        <td align="center"><input type="submit" value="Login">
        </td>
    </tr>
    </table>
    </fieldset>
</form>
<br>
<br>
<hr>
<TABLE width="100%">
<TR>
    <TD width="52%"><H5>Department of Construction Science </H5></TD>

```

```

        <TD width="48%" align="right"><H5>Technical Problem? mail to <A
HREF="mailto:neraath@tamu.edu">Web Admin.</A></H5></TD>
    </TR>
    <TR>
        <TD><H5>Texas A&M University - [Software Version: April 10,
2014]</H5></TD>
        <TD align="right"><H5>Institutional Review Board matters about the research,
mail to <A HREF="mailto:salderate@tamu.edu">IRB.</A></H5></TD>
    </TR>
</TABLE></td>
</tr>
</table>
</center>
</div>
</body>
</html>
<!--#include file="db_close.asp"-->

```

A.2 DB_OPEN.ASP

```

<%
Dim Conn, ConnString
Set Conn = Server.CreateObject("ADODB.Connection")
ConnString = "Provider=SQLOLEDB;" & _
    "Data Source=bid.arch.tamu.edu;Initial Catalog=bid;User
ID=bid;password=Aggies12"
Conn.Open(ConnString)%>

```

A.3 DB_CLOSE.ASP

```

<%
Conn.close
set Conn=nothing
%>

```

A.4 DAYSETTING.ASP


```
<!--#include file="start_time.asp"-->
```

```
<%
```

```
    'Set the dates and times variable
```

```
        'The original coder used a hard coded set of days, I am going to try and get to a  
recursive set of days and time.
```

```
Dim now_date
```

```
    Dim now_day
```

```
    Dim now_week
```

```
    Dim recursive_date_diff
```

```
    Dim recursive_date
```

```
    Dim recursive_part_week
```

```
    Dim recursive_day
```

```
    Dim recursive_week
```

```
    Dim number_minutes
```

```
now_date = 0
```

```
now_day = "Days are not set up."
```

```
recursive_week= "Experiment has not started yet."
```

```
' Find the time interval.
```

```
' Take the top two (distinct) start times, and find their difference.
```

```
' that's the number of minutes to run each auction
```

```
mySQL = "SELECT DISTINCT TOP 2 JobBidStartTime FROM tblJob"
```

```
set rsInterval = Conn.Execute(mySQL)
```

```
if not rsInterval.eof then
```

```
    rsInterval.MoveFirst
```

```
    time1 = rsInterval(0)
```

```
    rsInterval.MoveNext
```

```
    time2 = rsInterval(0)
```

```
    number_minutes = DateDiff("n", time1, time2)
```

```
else
```

```
    Response.Write "COULD NOT SET START TIME"
```

```
end if
```

```
'number_minutes = 10
```

```
'Set the recursive date to the time difference (29 May 2006)
```

```
recursive_date_diff = DateDiff("n", DateAdd("n", 0, start_time), now) mod  
number_minutes
```

```

    recursive_day = (int((DateDiff("n", DateAdd("n", 0, start_time),
now)/number_minutes)))*7
    recursive_part_week = (DateDiff("n", DateAdd("n", 0, start_time),
now)/number_minutes) - int((DateDiff("n", DateAdd("n", 0, start_time),
now)/number_minutes))
    if recursive_part_week <= 0.75 then
        Monday
        recursive_day = recursive_day + 1
    elseif recursive_part_week > 0.75 and recursive_part_week <= 0.80 then
        Tuesday
        recursive_day = recursive_day + 2
    elseif recursive_part_week > 0.80 and recursive_part_week <= 0.85 then
        Wednesday
        recursive_day = recursive_day + 3
    elseif recursive_part_week > 0.85 and recursive_part_week <= 0.90 then
        Thursday
        recursive_day = recursive_day + 4
    elseif recursive_part_week > 0.90 and recursive_part_week <= 0.95 then
        Friday
        recursive_day = recursive_day + 5
    elseif recursive_part_week > 0.95 and recursive_part_week <= 1.00 then
        Saturday
        recursive_day = recursive_day + 6
    end if
    'Now date is just a dummy name used for the remainder of the code.
    now_date = recursive_day
    'Determine the week number.
    recursive_week = (int((DateDiff("n", DateAdd("n", 0, start_time),
now)/number_minutes))+1
    'Determine the Day of the Week from the recursive date.
    if recursive_date_diff < 15 then
        now_day = "Monday"
    end if
    if recursive_date_diff = 15 then
        now_day = "Tuesday"
    end if
    if recursive_date_diff = 16 then
        now_day = "Wednesday"
    end if
    if recursive_date_diff = 17 then
        now_day = "Thursday"
    end if
    if recursive_date_diff = 18 then

```

```

now_day = "Friday"
end if
if recursive_date_diff = 19 then
now_day = "Saturday"
end if
'End new code

```

```
%>
```

A.5 START_TIME.ASP

```
<%
```

```

mysql = "SELECT min(JobBidStartTime) FROM tblJob"
set rsStart = Conn.Execute(mysql)
if not rsStart.eof then
    rsStart.MoveFirst
    start_time = rsStart(0)
else
    Response.Write "COULD NOT SET START TIME"
end if

```

```
%>
```

A.6 LOGIN_CHECK.ASP

```
<!--#include file="db_open.asp"-->
```

```
<%
```

```

usrLogID=request("usrLogID")
usrPassword=request("usrPassword")

mysql="SELECT * FROM tblContractor WHERE ctrUsername='" & usrLogID & "'
AND ctrPassword='" & usrPassword & "'"
set rsUser=Conn.execute(mysql)

if not rsUser.eof Then
    Response.Cookies("robbid")("usrID") = rsUser("ctrID")
    remoteIP = Request.ServerVariables("REMOTE_ADDR")

```

```

        'if not remoteIP = "165.91.196.188" and not remoteIP = "165.91.6.149" and not
remoteIP = "165.91.5.214" Then
            mySQL="INSERT INTO tblLog (ctrID, logTime, logIP) VALUES (" &
rsUser("ctrID") & ", " & now & ", " & remoteIP & ")"
            set rsTemp=conn.execute(mySQL)
            set rsTemp = Nothing
        'end If
    ,
    end If
%>

<!--#include file="db_close.asp"-->

<%
    If Request.Cookies("robbid").Haskeys then
        response.redirect "bid_before.asp"
    Else
        response.redirect "index.asp"
    end If
%>

```

A.7 BID_BEFORE.ASP

```

<!--#include file="db_open.asp"-->
<%
    'Coded: Yong Kim 2004
    'Amended John Nichols 2006
    'Called from login_check.asp
    'This program returns the capacity, warnings and userID

warning = request("w")
ctrID = Request.Cookies("robbid")("usrID")

mySQL = "SELECT * FROM tblJob Where jobBidClosed=0"
set rsJob = Conn.Execute(mySQL)

if not rsJob.EOF then

```

```

Do until rsJob.EOF
    'mySQL = "SELECT * FROM tblSite Where siteID =" & rsJob("siteID")
    'set rsSite = Conn.Execute(mySQL)
    'Checking bids ended
    if DateDiff("s", rsJob("jobBidEndTime"), now) > 0 then
        mySQL="UPDATE tblJob SET "
        mySQL=mySQL & " jobBidClosed=1"
        mySQL=mySQL & " WHERE jobID=" & rsJob("jobID")
        set rsTemp=Conn.execute(mySQL)
        set rsTemp = nothing

        'Return job capacity after bids
        mySQL="UPDATE tblContractor SET "
        mySQL=mySQL & " ctrCapacity=3"
        'mySQL=mySQL & " WHERE ctrID = 1"
        set rsTemp=Conn.execute(mySQL)
        set rsTemp = nothing
        'response.write("test")

    end if
    'Set rsSite = nothing

rsJob.movenext
Loop
Set rsJob = nothing

End if

%>
<!--#include file="db_close.asp"-->
<%
    response.redirect "bid.asp?w=" & warning
%>

```

A.8 BID.ASP

```

<!--#include file="db_open.asp"-->
<html>
<head>

```

```

<title>Reverse Auction Bidding - ALL CURRENT BIDS</title>
<link rel="stylesheet" href="style.css">
</head>
<!--#include file="daysetting.asp"-->
<%
ctrID = Request.Cookies("robbid")("usrID")
warning = request("w")
if warning="" then
    warning = "0"
end if

mySQL = "SELECT * FROM tblContractor Where ctrID =" & ctrID
set rsCtr = Conn.Execute(mySQL)

'Counting jobs in progress
mySQL = "SELECT * FROM tblJob Where jobBidClosed=1 And jobConstEnded = 0
And ctrID=" & ctrID
set rsCount = Conn.Execute(mySQL)
count = 0
<!--!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! I need too fixer this too make the counter correct. -
->

Do until rsCount.EOF
    Count = count + 1
rsCount.movenext
Loop
set rsCount = nothing

'counting current bids
mySQL = "SELECT * FROM tblJob Where jobBidClosed = 0 And ctrID=" & ctrID &
"And jobBeginDate =" & now_date
set rsCount2 = Conn.Execute(mySQL)
'response.write(mySQL)
count2 = 0
Do until rsCount2.EOF
    count2 = count2 + 1
rsCount2.movenext
Loop
set rsCount2 = nothing
%>
<BODY oncontextmenu="return false" class="body">
<div align="center">
    <table width="90%" cellspacing="0" cellpadding="0" height="100%" class="body" >

```

```

<tr>
  <td valign="top"><!-- First Sub Table -->
    <TABLE width="100%">
      <TR>
        <TD width="43%" > <H4><%=rsCtr("ctrName")%>'s RAB - ALL CURRENT
BIDS</H4>
        <p><A HREF="bid_before.asp"><B> </B></A></p></TD>
        <TD width="57%" align="right" ><A HREF="bid_before.asp"><B>[ALL
CURRENT BIDS]</B></A> <A HREF="close.asp"><B>[ALL COMPLETED
JOBS]</B></A> <A HREF="info_before.asp"><B>[MY BIDS INFO]</B></A><A
HREF="logout.asp"><B>[LOGOUT]</B></A></TD>
      </TR>
    </TABLE>
    <hr>
    <!-- Second Sub Table -->
    <TABLE width="100%">
      <TR>
        <TD><H4>Now: Day<%=now_date%>
(<%=now_day%>),Week:<%=recursive_week%> </H4></TD>
        <TD align="right"><iframe scrolling="no" frameborder="0"
style="overflow:hidden;border:0;margin:0;padding:0;width:120px;height:40px;"
src="http://www.clocklink.com/html5embed.php?clock=004&timezone=CST&color=pi
nk&size=120"></iframe>
      </TD>
    <TD>
      <%=
        set rsWeather = nothing
      <%=>
    </TD>
      </TR>
    </TABLE>
    <fieldset>
    <legend>
    <H4>Notices</H4>
    </legend>
    <!-- Third Sub Table -->

    <%= 'Warning if project not started
      if DateDiff("s",start_time, now) < 0 then%>
    <CENTER>
    <B>The Test Experiment will start at <%=start_time%>. See you soon.</B><BR>
    <BR>
    </CENTER>
    <%=end if%>
    <%= 'Warning if capacity is over

```

```

    if count2>=(rsCtr("ctrCapacity")-count) then%>
<CENTER>
    <B>Currently your capacity is full including current winning bids and jobs in
progress. <BR>
    You cannot bid at this time.</B><BR>
    <BR>
    <form action="loan.asp" type="post">
    If you ask for a Bank Guarantee, you can increase your capacity. Bank Guarantee
fee is $500 per guarantee. Do you want?
    <INPUT TYPE="submit" value="YES">
    </form>
</CENTER>
<%end if%>
<% 'Warning if bid amount is high
    if warning = "1" then%>
<CENTER>
    <B>Your bid amount is higher than current lowest bid amount.<BR>
    <BR>
    Don't forget this is a reverse auction.<BR>
    <BR>
    Check the current bid amount and try again.</B><BR>
    <BR>
</CENTER>
<%end if%>
<% 'Warning if cents was input
    if warning = "2" then%>
<CENTER>
    <B>Minimum decreasing bidding amount is "$1"<BR>
    <BR>
    Do not put the cents on the bid amount<BR>
    <BR>
    Check the current bid amount and try again!!!</B><BR>
    <BR>
</CENTER>
    <%end if%>
    <% 'Less than company cost of labour and materials
    if warning = "3" then%>
<CENTER>
    <B>You can not bid less than the company estimate of the minimum material and
labour cost - at all.<BR>
    <BR>
    Check the current bid amount, and the company cost and try again. We do not
need bankrupt suppliers.</B><BR>

```



```

<BR>
</CENTER>
<%end if%>
    <% 'Less than company cost of labour and materials
        if warning = "4" then%>
<CENTER>
    <B>Come on, even we do not like to get ripped off that much.<BR>
<BR>
    Check the current bid amount, and the company cost and try again. We do not
    need filthy rich suppliers.</B><BR>
<BR>
</CENTER>
<%end if%>
</fieldset>
<br>
<BR>
<%
    mySQL = "SELECT * FROM tblJob Where jobBidClosed=0 And jobBeginDate
< " & (now_date+6)
    set rsJob = Conn.Execute(mySQL)
%>
<!-- Fourth Sub Table -->
<table border="1" frame="void" rules="rows" bordercolor="#dddddd"
cellpadding="0" cellspacing="0" style="border-collapse: collapse;" width="100%">
<tr>
    <td bgcolor="#6699CC" width="2"></td>
    <td bgcolor="#6699CC" colspan="12"><B>All Current Bids</B></td>
    <td bgcolor="#6699CC" colspan="11" align="right"></td>
    <td bgcolor="#6699CC" width="2"></td>
</tr>
<tr>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">JOB#</td>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">LOCATION</td>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">TRAVEL COST</td>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">DELIVERY COST</td>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">ESTIMATED COST</td>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">CURRENT PRICE</td>

```

```

<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">Ept. Profit</td>
<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">Ept. Profit%</td>
<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">BIDDER</td>
<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">Bid Date</td>
<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">MY PRICE</td>
<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">SUBMIT</td>
<td bgcolor="#dddddd" width="2"></td>
</tr>
<%
    mySQL = "SELECT * FROM tblJob Where jobBidClosed=0 And
jobBeginDate < " & (now_date+6)
    set rsJob = Conn.Execute(mySQL)
%>
<%
    if not rsJob.EOF then
    Do until rsJob.EOF
    mySQL = "SELECT * FROM tblSite Where siteID =" & rsJob("siteID")
    set rsSite = Conn.Execute(mySQL)

    mySQL = "SELECT * FROM tblContractor Where ctrID =" &
rsJob("ctrID")
    set rsContractor = Conn.Execute(mySQL)
    total_cost = rsSite("siteDeliveryCost") +
((rsSite("siteTravelCost") + 2000) * 5)

    if not rsJob("jobPrice")= 0 then
    ept_profit = rsJob("jobPrice") - total_cost
    ept_pProfit = (ept_profit/rsJob("jobPrice"))
    ept_pProfit = FormatPercent(ept_pProfit, 2, -1, 0, 0)
    else
        ept_profit = 0
        ept_pProfit = "- %"
    end if
%>
</tr>

```

```

        <form action="bid_after.asp" method="post">
            <td width="2"></td>
            <td ALIGN="CENTER"><A
HREF="history.asp?JID=<%=rsJob("jobID")%>"><%=rsJob("jobID")%></A></td>
            <td width="2"></td>
            <td ALIGN="CENTER"><%=rsSite("siteLocation")%></td>
            <td width="2"></td>
            <td ALIGN="CENTER">$ <%=rsSite("siteTravelCost")%></td>
            <td width="2"></td>
            <td ALIGN="CENTER">$ <%=rsSite("siteDeliveryCost")%></td>
            <td width="2"></td>
            <td ALIGN="CENTER">$ <%=total_cost%></td>
            <td width="2"></td>
            <td ALIGN="CENTER"><A
HREF="history.asp?JID=<%=rsJob("jobID")%>">$ <%=rsJob("jobPrice")%></A></td>
        >

            <td width="2"></td>
            <td ALIGN="CENTER">$ <%=ept_profit%></td>
            <td width="2"></td>
            <td ALIGN="CENTER"><%=ept_pProfit%></td>
            <td width="2"></td>
            <td ALIGN="CENTER"><%=rsContractor("ctrName")%></td>
            <td width="2"></td>
            <td ALIGN="CENTER" class="Red">Day
<%=rsJob("jobBeginDate")%></td>
            <td width="2"></td>
            <td ALIGN="CENTER"><%if (DateDiff("s", rsJob("jobBidStartTime"),
now))>0 then %>
                <INPUT TYPE="text" NAME="bidAmount" <%if (DateDiff("s",
rsJob("jobBidStartTime"), now))<0 then %>disabled<%end if%><%if
count2>=(rsCtr("ctrCapacity")-count) then %>disabled<%end if%> size=10>
                <%end if%></td>
            <td width="2"></td>
            <td ALIGN="CENTER"><%if (DateDiff("s", rsJob("jobBidStartTime"),
now))>0 then %>
                <INPUT TYPE="submit" value="SUBMIT" <%if (DateDiff("s",
rsJob("jobBidStartTime"), now))<0 then %>disabled<%end if%><%if
count2>=(rsCtr("ctrCapacity")-count) then %>disabled<%end if%>>
                <%end if%></td>
            <td width="2"></td>
            <INPUT TYPE="hidden" name="count2" value="<%=count2%>">
            <INPUT TYPE="hidden" name="now_date" value="<%=now_date%>">
            <INPUT TYPE="hidden" name="JID" value="<%=rsJob("jobID")%>">

```



```

<!--#include file="db_open.asp"-->
<%
    'Coded: Yong Kim 2004
    'Amended John Nichols 2006
    'Called from login_check.asp
    'This program returns the capacity, warnings and userID

warning = request("w")
ctrID = Request.Cookies("robbid")("usrID")

mySQL = "SELECT * FROM tblJob Where jobBidClosed=0"
set rsJob = Conn.Execute(mySQL)

if not rsJob.EOF then

Do until rsJob.EOF
    'mySQL = "SELECT * FROM tblSite Where siteID =" & rsJob("siteID")
    'set rsSite = Conn.Execute(mySQL)
    'Checking bids ended
    if DateDiff("s", rsJob("jobBidEndTime"), now) > 0 then
        mySQL="UPDATE tblJob SET "
        mySQL=mySQL & " jobBidClosed=1"
        mySQL=mySQL & " WHERE jobID=" & rsJob("jobID")
        set rsTemp=Conn.execute(mySQL)
        set rsTemp = nothing

        'Return job capacity after bids
        mySQL="UPDATE tblContractor SET "
        mySQL=mySQL & " ctrCapacity=3"
        'mySQL=mySQL & " WHERE ctrID = 1"
        set rsTemp=Conn.execute(mySQL)
        set rsTemp = nothing
        'response.write("test")

    end if
    'Set rsSite = nothing

rsJob.movenext
Loop
Set rsJob = nothing

End if

```

```

%>
<!--#include file="db_close.asp"-->
<%
    response.redirect "bid.asp?w=" & warning
%>

```

A.10 BID_AFTER.ASP

```

<!--#include file="db_open.asp"-->

< SCRIPT LANGUAGE="VBScript" >
Sub button0_onclick
    MsgBox "Please Click OK"
End Sub
< /SCRIPT >

<%
jobID = request("JID")
ctrID = Request.Cookies("robbid")("usrID")
bidAmount = request("bidAmount")
bidDate = request("now_date")
bidTime = Time()
companycost = request("COST_JOB")
Uppercompanycost = 3.5*companycost
lowercompanycost = 0.9*companycost

mySQL = "SELECT * FROM tblJob Where jobID=" & jobID
set rsJob = Conn.Execute(mySQL)

'response.write("rsJob(jobPrice):")
'response.write(rsJob("jobPrice"))
'response.write("<br>")
'response.write("<br>")

if rsJob("jobPrice")="" then
    jobPrice = 0
else
    jobPrice = rsJob("jobPrice")
end if

```

```

jobPrice = Cnsg(jobPrice)
bidAmount = Cnsg(bidAmount)

'response.write("jobPrice:")
'response.write(jobPrice)
'response.write(vartype(jobPrice))
'response.write("<br>")
'response.write("bidAmount:")
'response.write(bidAmount)
'response.write(vartype(bidAmount))
'response.write("<br>")
'response.write("<br>")
'response.write("<br>")

warning = "0"

if not (bidAmount mod 1) = 0 then
    warning = "2"

elseif bidAmount > Uppercompanycost then
    warning = "4"

elseif bidAmount < Lowercompanycost then
    warning = "3"

elseif jobPrice = 0 or jobPrice > bidAmount then
    mySQL="INSERT INTO tblBid (jobID, ctrID, bidAmount, bidDate, bidTime) "
    -
    &"VALUES (" & jobID & ", " & ctrID & ", " & bidAmount & ", " & bidDate & ",
    "" & bidTime & "")"
    set rsTemp=conn.execute(mySQL)
    set rsTemp = nothing
    'response.write ("test1")

    mySQL="UPDATE tblJob SET "
    mySQL=mySQL & " jobPrice=" & bidAmount & ""
    mySQL=mySQL & ", ctrID=" & ctrID & ""
    mySQL=mySQL & " WHERE jobID=" & jobID
    set rsTemp=Conn.execute(mySQL)
    set rsTemp = nothing
else
    warning = "1"

```

```

        response.write ("test3")

end if
%>
<!--#include file="db_close.asp"-->
<%
        response.redirect "bid_before.asp?W=" & warning
%>

```

A.11 HISTORY.ASP

```

<!--#include file="db_open.asp"-->
<html>
<head>
<title>Reverse Auction Bidding - BID HISTORY</title>
<link rel="stylesheet" href="style.css">
</head>
<!--#include file="daysetting.asp"-->
<%
ctrID = Request.Cookies("robbid")("usrID")
JID = request("JID")
%>
<BODY>
<div align="center">
<table width="90%" cellspacing="0" cellpadding="0" >
<tr>
<td valign="top"><TABLE width="100%">
<TR>
<%
        mySQL = "SELECT * FROM tblContractor Where ctrID =" & ctrID
        set rsContractor = Conn.Execute(mySQL)
%>
        <TD><H4 class="H4"><%=rsContractor("ctrName")%>'s RAB - SITE BID
HISTORY</H4></TD>
        <TD align="right"><A HREF="bid_before.asp"><B>[ALL CURRENT
BIDS]</B></A> <A HREF="close.asp"><B>[ALL COMPLETED JOBS]</B></A>
<A HREF="info_before.asp"><B>[MY BIDS INFO]</B></A> <A
HREF="logout.asp"><B>[LOGOUT]</B></A></TD>
</TR>

```



```

</TABLE>
<hr>
<TABLE width="100%">
  <TR>
    <TD><H4 class="H4">Now: Day<%=now_date%> (<%=now_day%>),
Week:<%=recursive_week%></H4></TD>
    <TD align="right"></TD>
  <%
    set rsWeather = nothing
    set rsContractor = nothing
  %>
</TR>
</TABLE>
<BR>
<table border="1" frame="void" rules="rows" cellpadding="0" cellspacing="0"
style="border-collapse: collapse;" width="100%">
  <tr>
    <td width="2"></td>
    <td colspan="7"><B>Bid History of job #<%=JID%></B></td>
    <td width="2"></td>
  </tr>
  <tr>
    <td width="2"></td>
    <td ALIGN="CENTER">Bidding Date</td>
    <td width="2"></td>
    <td ALIGN="CENTER">Bidding Time</td>
    <td width="2"></td>
    <td ALIGN="CENTER">Contractor</td>
    <td width="2"></td>
    <td ALIGN="CENTER">Bid Amount</td>
    <td width="2"></td>
  </tr>
  <%
    mySQL = "SELECT * FROM tblBid Where jobID=" & JID
    set rsBid = Conn.Execute(mySQL)

    if not rsBid.EOF then

      Do until rsBid.EOF

        mySQL = "SELECT * FROM tblContractor Where ctrID =" & rsBid("ctrID")
        set rsContractor = Conn.Execute(mySQL)
  %>

```

```

</tr>
  <td width="2"></td>
  <td ALIGN="CENTER">Day <%=rsBid("bidDate")%></td>
  <td width="2"></td>
  <td ALIGN="CENTER"><%=rsBid("bidTime")%></td>
  <td width="2"></td>
  <td ALIGN="CENTER"><%=rsContractor("ctrName")%></td>
  <td width="2"></td>
  <td ALIGN="CENTER">$ <%=rsBid("bidAmount")%></td>
  <td width="2"></td>
</tr>
<%
  Set rsContractor = nothing

  rsBid.movenext
  Loop
  Set rsBid = nothing

  else
    %>
    <tr>
      <td width="2"></td>
      <td ALIGN="CENTER" colspan="7"></td>
      <td width="2"></td>
    </tr>
    <td width="2"></td>
    <td ALIGN="CENTER" colspan="7">There is no bidding history for job
#<%=JID%></td>
      <td width="2"></td>
    </tr>
    <td width="2"></td>
    <td ALIGN="CENTER" colspan="7"></td>
    <td width="2"></td>
  </tr>
</tr>

  <td width="2"></td>
  <td ALIGN="CENTER" colspan="7"></td>
  <td width="2"></td>
</tr>
<%
  end if
%>

```

```

        </table></td>
    </tr>
</div>
</BODY>
</HTML>
<!--#include file="db_close.asp"-->

```

A.12 LOAN.ASP

```

<!--#include file="db_open.asp"-->
<%
ctrID = Request.Cookies("robbid")("usrID")

mySQL = "SELECT * FROM tblContractor Where ctrID=" & ctrID
set rsCtr = Conn.Execute(mySQL)
new_ctrCapacity = rsCtr("ctrCapacity") + 1
new_loan = rsCtr("ctrLoan") + 500
mySQL="UPDATE tblContractor SET "
mySQL=mySQL & " ctrCapacity=" & new_ctrCapacity & ""
mySQL=mySQL & ", ctrLoan=" & new_loan & ""
mySQL=mySQL & " WHERE ctrID=" & ctrID
set rsTemp=Conn.execute(mySQL)
set rsTemp = nothing

mySQL="INSERT INTO tblLoan (ctrID, loanAmount, time) " & "VALUES (" & ctrID
& ", " & bidAmount & ", " & bidTime & ")"
'set rsTemp=conn.execute(mySQL)
'set rsTemp = nothing

%>
<!--#include file="db_close.asp"-->
<%
    response.redirect "bid_before.asp?W=" & warning
%>

```

A.13 CLOSE.ASP

```

<!--#include file="db_open.asp"-->
<html>
<head>
<title>Reverse Auction Bidding - ALL COMPLETED JOBS</title>
<link rel="stylesheet" href="style.css">
</head>
<!--#include file="daysetting.asp"-->
<%
ctrID = Request.Cookies("robbid")("usrID")
%>
<%
mySQL = "SELECT * FROM tblJob Where jobBidClosed=1 And jobConstEnded = 0
And jobPrice > 0"
set rsJob = Conn.Execute(mySQL)

If rsJob.EOF then

else
    total_cost2date = 0
    Do until rsJob.EOF

        mySQL = "SELECT * FROM tblSite Where siteID =" & rsJob("siteID")
        set rsSite = Conn.Execute(mySQL)

        mySQL = "SELECT * FROM tblWeather Where siteID =" & rsSite("siteID") &
" And wtDate > " & rsJob("jobBeginDate") & "And wtDate <= " & now_date
        set rsWeather = Conn.Execute(mySQL)

        rainy_days = 0
        Do until rsWeather.EOF
            rainy_days = rainy_days + 1
            rsWeather.movenext
        Loop

        all_UC_days = now_date -

rsJob("jobBeginDate")

        UC_days = all_UC_days -

        rainy_days

        'response.write("<b>")
        'response.write("job ID:")
        'response.write(rsJob("jobID"))

```

```

'response.write("</b>")
'response.write("<br>")
'response.write("all_UC_days1:")
'response.write(all_UC_days)
'response.write("<br>")
'response.write("rainy_days1:")
'response.write(rainy_days)
'response.write("<br>")
'response.write("UC_days1:")
'response.write(UC_days)
'response.write("<br>")
'response.write("<br>")

if UC_days > 5 then
'response.write ("test1")
last_UC_days =

rsJob("jobBeginDate") + 5

UC_days = 0
Do until UC_days = 5
'response.write ("test2")
mysql = "SELECT *
FROM tblWeather Where siteID = "&rsJob("siteID")&" And wtDate > " &
rsJob("jobBeginDate") & "And wtDate <= " & last_UC_days
set rsWeather =
Conn.Execute(mysql)

'response.write (mysql)

rainy_days = 0
Do until rsWeather.EOF
rainy_days =

rainy_days + 1

rsWeather.movenext
Loop

UC_days = last_UC_days -

rsJob("jobBeginDate") - rainy_days

'response.write ("<br>")
'response.write ("all_UC_days:")
'response.write (all_UC_days)
'response.write ("<br>")
'response.write ("last_UC_days:")

```

```

'response.write (last_UC_days)
'response.write ("<br>")
'response.write ("rainy_days:")
'response.write (rainy_days)
'response.write ("<br>")
'response.write ("UC_days:")
'response.write (UC_days)
'response.write ("<br>")
'response.write ("<br>")

        if UC_days < 5 then
            last_UC_days =

last_UC_days + 1

        end if
Loop
'response.write ("Finished")
'UC_days = all_UC_days -

rainy_days

'UC_days = UC_days

end if

        if UC_days = 5 then
            cost2date =
rsSite("siteDeliveryCost") + ((rsSite("siteTravelCost") + 2000) * 5)
        else
            cost2date =
(rsSite("siteTravelCost") + 2000) * UC_days
        end if

cost2date

profit2date = rsJob("jobPrice") -

Const_Start =

Const_End = Const_Start +

rainy_days + 4

total_cost2date = total_cost2date +

cost2date

        if UC_days = 5 then

```

```

        response.redirect "close_after.asp?JID=" & rsJob("jobID") &
"&cstrCost=" & cost2date & "&cstrProfit=" & profit2date & "&cstrDelay=" &
rainy_days & "&cstrUC=" & UC_days & "&cstrBeginDate=" & Const_Start & "
&cstrEndDate=" & Const_End
    end if
    set rsWeather = nothing

    rsJob.movenext
    Loop
    Set rsJob = nothing

end if

%>
<BODY oncontextmenu="return false" class="body">
<div align="center">
<table width="90%" cellspacing="0" cellpadding="0" height="100%" class="body">
<tr>
    <td valign="top"><TABLE width="100%">
        <TR>
            <%
                mySQL = "SELECT * FROM tblContractor Where ctrID ="& ctrID
                set rsContractor = Conn.Execute(mySQL)
            %>
            <TD ><H4 class="H4"><%=rsContractor("ctrName")%>'s RAB - ALL
COMPLETED JOBS</H4></TD>
            <TD align="right"><A HREF="bid_before.asp"><B>[ALL CURRENT
BIDS]</B></A> <A HREF="close.asp"><B>[ALL COMPLETED JOBS]</B></A>
<A HREF="info_before.asp"><B>[MY BIDS INFO]</B></A> <A
HREF="logout.asp"><B>[LOGOUT]</B></A></TD>
        </TR>
    </TABLE>
    <hr>
    <TABLE width="100%">
        <TR>
            <TD><H4 class="H4">Now: Day<%=now_date%>
(<%=now_day%>),Week:<%=recursive_week%></H4></TD>
            <TD align="right"></TD>
        </TR>
    </TABLE>
    <BR>
    <%
        set rsContractor = nothing
    %>
</TR>
</TABLE>
<BR>

```

```
<table border="1" frame="void" rules="rows" cellpadding="0" cellspacing="0" style="border-collapse: collapse;" width="100%">
```

```
<tr>
  <td bgcolor="#6699CC" width="2"></td>
  <td bgcolor="#6699CC" colspan="19"><B>My Completed jobs</B></td>
  <td bgcolor="#6699CC" width="2"></td>
</tr>
<tr>
  <td bgcolor="#dddddd" width="2"></td>
  <td bgcolor="#dddddd" ALIGN="CENTER">Job#</td>
  <td bgcolor="#dddddd" width="2"></td>
  <td bgcolor="#dddddd" ALIGN="CENTER">Site</td>
  <td bgcolor="#dddddd" width="2"></td>
  <td bgcolor="#dddddd" ALIGN="CENTER">Bid Date</td>
  <td bgcolor="#dddddd" width="2"></td>
  <td bgcolor="#dddddd" ALIGN="CENTER">Bid Amount</td>
  <td bgcolor="#dddddd" width="2"></td>
  <td bgcolor="#dddddd" ALIGN="CENTER">Cost</td>
  <td bgcolor="#dddddd" width="2"></td>
  <td bgcolor="#dddddd" ALIGN="CENTER">Profit</td>
  <td bgcolor="#dddddd" width="2"></td>
  <td bgcolor="#dddddd" ALIGN="CENTER">Start day</td>
  <td bgcolor="#dddddd" width="2"></td>
  <td bgcolor="#dddddd" ALIGN="CENTER">End day</td>
  <td bgcolor="#dddddd" width="2"></td>
  <td bgcolor="#dddddd" ALIGN="CENTER">Rainy days</td>
  <td bgcolor="#dddddd" width="2"></td>
  <td bgcolor="#dddddd" ALIGN="CENTER">Profit Rate</td>
  <td bgcolor="#dddddd" width="2"></td>
</tr>
```

```
<%
```

```

    mySQL = "SELECT * FROM tblJob Where jobConstEnded=1 And
jobPrice > 0"
    set rsJob = Conn.Execute(mySQL)

    if not rsJob.EOF then

    Do until rsJob.EOF

    mySQL = "SELECT * FROM tblSite Where siteID =" & rsJob("siteID")
    set rsSite = Conn.Execute(mySQL)

    mySQL = "SELECT * FROM tblBid Where jobID =" & rsJob("jobID")

```



```

        set rsBid = Conn.Execute(mySQL)

        mySQL = "SELECT * FROM tblConstruction Where jobID =" &
rsJob("jobID")
        set rsCstr = Conn.Execute(mySQL)

        mySQL = "SELECT * FROM tblContractor Where ctrID =" &
rsJob("ctrID")
        set rsCtr = Conn.Execute(mySQL)

        pProfit = (rsCstr("cstrProfit")/rsJob("jobPrice"))
        pProfit = FormatPercent(pProfit, 2, -1, 0, 0)
        'response.write(rsCstr("cstrProfit"))
        'response.write("<Br>")
        'response.write(rsJob("jobPrice"))

```

```

        %>
<tr>
    <td width="2"></td>
    <td ALIGN="CENTER"><%=rsJob("jobID")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER"><%=rsSite("siteLocation")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER">Day <%=rsBid("bidDate")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER">$ <%=rsJob("jobPrice")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER">$ <%=rsCstr("cstrCost")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER">$ <%=rsCstr("cstrProfit")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER">Day <%=rsCstr("cstrBeginDate")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER">Day <%=rsCstr("cstrEndDate")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER">Day <%=(rsCstr("cstrEndDate") -
rsCstr("cstrBeginDate") -4)%></td>
    <td width="2"></td>
    <td ALIGN="CENTER"><%=pProfit%></td>
    <td width="2"></td>
</tr>
    <%

```

```

        Set rsSite = nothing

```

```

        Set rsBid = nothing
        Set rsCtr = nothing

        rsJob.movenext
        Loop
        Set rsJob = nothing

    else
        %>
        <tr>
            <td ALIGN="CENTER" colspan="21"></td>
        <tr> </tr>
        <td ALIGN="CENTER" colspan="21">There are no finished jobs</td>
        <tr> </tr>
        <td ALIGN="CENTER" colspan="21"></td>
        </tr>
        <%
            end if
        %>
        <tr>
            <td colspan="21"></td>
        </tr>
        </table></td>
    </tr>
</div>
</BODY>
</HTML>
<!--#include file="db_close.asp"-->

```

A.14 Close_AFTER.ASP

```

<!--#include file="db_open.asp"-->
<%
ctrID = Request.Cookies("robbid")("usrID")
jobID = request("JID")
cstrCost = request("cstrCost")
cstrProfit = request("cstrProfit")
cstrDelay = request("cstrDelay")
cstrUC = request("cstrUC")

```

```

cstrBeginDate = request("cstrBeginDate")
cstrEndDate = request("cstrEndDate")

mySQL="INSERT INTO tblConstruction (ctrID, jobID, cstrCost, cstrProfit, cstrDelay,
cstrUC, cstrBeginDate, cstrEndDate) " _
&"VALUES ("& ctrID &", "& jobID &", "& cstrCost &", "& cstrProfit &", "&
cstrDelay &", "& cstrUC &", "& cstrBeginDate &", "& cstrEndDate &")"
set rsTemp=conn.execute(mySQL)
set rsTemp = nothing
response.write (mySQL)

mySQL="UPDATE tblJob SET "
mySQL=mySQL & " jobConstEnded=1"
mySQL=mySQL & " WHERE jobID=" & jobID
set rsTemp=Conn.execute(mySQL)
set rsTemp = nothing

%>
<!--#include file="db_close.asp"-->
<%
    response.redirect "close.asp"
%>

```

A.15 INFO.ASP

```

<!--#include file="db_open.asp"-->
<html>
<head>
<title>Reverse Auction Bidding - MY BIDS INFORMATION</title>
<link rel="stylesheet" href="style.css">
</head>
<!--#include file="daysetting.asp"-->
<%
ctrID = Request.Cookies("robbid")("usrID")
%>
<BODY oncontextmenu="return false" class="body">
<div align="center">
    <table width="90%" cellspacing="0" cellpadding="0" height="100%" >
        <tr>

```

```

<td valign="top"><TABLE width="100%">
  <TR>
    <%
      mySQL = "SELECT * FROM tblContractor Where ctrID =" & ctrID
      set rsContractor = Conn.Execute(mySQL)
    %>
    <TD><H4 class="H4"> <%=rsContractor("ctrName")%>'s RAB - MY BIDS'
INFORMATION</H4></TD>
    <TD align="right"><A HREF="bid_before.asp"><B>[ALL CURRENT
BIDS]</B></A> <A HREF="close.asp"><B>[ALL COMPLETED JOBS]</B></A>
<A HREF="info_before.asp"><B>[MY BIDS INFO]</B></A> <A
HREF="logout.asp"><B>[LOGOUT]</B></A></TD>
  </TR>
</TABLE>
<hr>
<TABLE width="100%">
  <TR>
    <TD><H4 class="H4">Now: Day<%=now_date%> (<%=now_day%>),
Week:<%=recursive_week%></H4></TD>
    <TD align="right"></TD>
  <%
    set rsWeather = nothing
    set rsContractor = nothing
  %>
</TR>
</TABLE>
<BR>
<!-- ##### Table for My Active Bids [START] ##### -->
<table border="1" frame="void" rules="rows" bordercolor="#dddddd"
cellpadding="0" cellspacing="0" style="border-collapse: collapse;" width="100%">
  <tr>
    <td bgcolor="#6699CC" width="2"></td>
    <td bgcolor="#6699CC" colspan="13"><B>My Active Bids</B></td>
    <td bgcolor="#6699CC" width="2"></td>
  </tr>
  <tr>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">JOB#</td>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">LOCATION</td>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">CURRENT PRICE</td>
    <td bgcolor="#dddddd" width="2"></td>

```

```

        <td bgcolor="#dddddd" ALIGN="CENTER">CURRENT BIDDER</td>
        <td bgcolor="#dddddd" width="2"></td>
        <td bgcolor="#dddddd" ALIGN="CENTER">TIME REMAINING</td>
        <td bgcolor="#dddddd" width="2"></td>
        <td bgcolor="#dddddd" ALIGN="CENTER">MY LOWEST BID
AMOUNT</td>
        <td bgcolor="#dddddd" width="2"></td>
        <td bgcolor="#dddddd" ALIGN="CENTER">OUTBID</td>
        <td bgcolor="#dddddd" width="2"></td>
    </tr>
    <%
        mySQL = "SELECT * FROM tblJob Where jobBidClosed=0 And
jobConstEnded = 0"
        set rsJob = Conn.Execute(mySQL)

        If rsJob.EOF then
M <%>
            <tr>
                <td colspan="17"></td>
            <tr>
            <tr>
                <td colspan="17" align="center">There are no my active bids !!!</td>
            <tr>
            <tr>
                <td colspan="17"></td>
            <tr>
            <%
                else

                Do until rsJob.EOF

                mySQL = "SELECT * FROM tblBid Where ctrID =" & ctrID & "And
jobID =" & rsJob("jobID")
                set rsBid = Conn.Execute(mySQL)

                mySQL = "SELECT * FROM tblSite Where siteID =" &
rsJob("siteID")
                set rsSite = Conn.Execute(mySQL)

                mySQL = "SELECT * FROM tblContractor Where ctrID =" &
rsJob("ctrID")
                set rsContractor = Conn.Execute(mySQL)

```

```

mySQL = "SELECT * FROM tblBid Where ctrID =" & ctrID &
"And jobID =" & rsJob("jobID") & " Order By bidAmount"
set rsTemp=Conn.Execute(mySQL)

```

```

If not rsBid.EOF then

```

```

    %>
    <tr>
    <td width="2"></td>
    <td ALIGN="CENTER"><%=rsJob("jobID")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER"><%=rsSite("siteLocation")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER">$ <%=rsJob("jobPrice")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER"><%=rsContractor("ctrName")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER"><%=DateDiff("s",now,rsJob("jobBidEndTime"))%>
seconds. </td>
    <td width="2"></td>
    <td ALIGN="CENTER">$ <%=rsTemp("bidAmount")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER"><%

```

```

        IF (rsJob("jobPrice") < rsTemp("bidAmount")) THEN

```

```

        %>
        <B><FONT COLOR="red">YES</FONT></B>

```

```

        <%
        END IF

```

```

        %>
    </td>
    <td width="2"></td>

```

```

</tr>
<%
    Set rsSite = nothing
    Set rsContractor = nothing
    end if

```

```

    rsJob.movenext
    Loop
    Set rsJob = nothing

```

```

End if

```

```

%>
<tr>
  <td colspan="19"></td>
</tr>
</table>
<!-- ##### Table for My Active Bids [END] ##### -->
<!-- ##### Table for Jobs in Progress [START] ##### -->
<BR>
<BR>
<BR>
<table border="1" frame="void" rules="rows" bordercolor="#dddddd"
cellpadding="0" cellspacing="0" style="border-collapse: collapse;" width="100%">
  <tr>
    <td bgcolor="#6699CC" width="2"></td>
    <td bgcolor="#6699CC" colspan="13"><B>My Jobs in Progress</B></td>
    <td bgcolor="#6699CC" width="2"></td>
  </tr>
  <tr>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">JOB#</td>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">LOCATION</td>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">Bid Amount</td>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">Job Start Date</td>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">Delays</td>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">Construction days</td>
    <td bgcolor="#dddddd" width="2"></td>
    <td bgcolor="#dddddd" ALIGN="CENTER">Cost to Date</td>
    <td bgcolor="#dddddd" width="2"></td>
  </tr>
<%
    mySQL = "SELECT * FROM tblJob Where jobBidClosed=1 And
jobConstEnded = 0 And jobPrice > 0 and ctrID=" & ctrID
    set rsJob = Conn.Execute(mySQL)

    If rsJob.EOF then

```

```

<tr>
  <td colspan="15"></td>
<tr>
<tr>
  <td colspan="15" align="center">There is no work in progress !!!</td>
<tr>
<tr>
  <td colspan="15"></td>
<tr>
  <%

```

```

else
total_cost2date = 0
Do until rsJob.EOF

```

```

rsJob("siteID")
mySQL = "SELECT * FROM tblSite Where siteID =" &
set rsSite = Conn.Execute(mySQL)

```

```

mySQL = "SELECT * FROM tblWeather Where siteID =" &
rsSite("siteID") & " And wtDate > " & rsJob("jobBeginDate") & "And wtDate <= " &
now_date
set rsWeather = Conn.Execute(mySQL)

```

```

rainy_days = 0
Do until rsWeather.EOF
  rainy_days = rainy_days + 1
rsWeather.movenext
Loop

```

```

all_UC_days = now_date - rsJob("jobBeginDate")
UC_days = all_UC_days - rainy_days

```

```

'response.write("<b>")
'response.write("job ID:")
'response.write(rsJob("jobID"))
'response.write("</b>")
'response.write("<br>")
'response.write("all_UC_days1:")
'response.write(all_UC_days)
'response.write("<br>")
'response.write("rainy_days1:")
'response.write(rainy_days)

```



```

'response.write("<br>")
'response.write("UC_days1:")
'response.write(UC_days)
'response.write("<br>")
'response.write("<br>")

    if UC_days > 5 then
        'response.write ("test1")
        last_UC_days = rsJob("jobBeginDate") + 5

        UC_days = 0
        Do until UC_days = 5
            'response.write ("test2")
            mySQL = "SELECT * FROM
tblWeather Where siteID = "&rsJob("siteID")&" And wtDate > " &
rsJob("jobBeginDate") & "And wtDate <= " & last_UC_days
            set rsWeather =
Conn.Execute(mySQL)

            'response.write (mySQL)

            rainy_days = 0
            Do until rsWeather.EOF
                rainy_days = rainy_days + 1
            rsWeather.movenext
            Loop

            UC_days = last_UC_days -
rsJob("jobBeginDate") - rainy_days

'response.write ("<br>")
'response.write ("all_UC_days:")
'response.write (all_UC_days)
'response.write ("<br>")
'response.write ("last_UC_days:")
'response.write (last_UC_days)
'response.write ("<br>")
'response.write ("rainy_days:")
'response.write (rainy_days)
'response.write ("<br>")
'response.write ("UC_days:")
'response.write (UC_days)
'response.write ("<br>")
'response.write ("<br>")

```

```

        if UC_days < 5 then
            last_UC_days = last_UC_days + 1
        end if
    Loop
    "response.write ("Finished")
    'UC_days = all_UC_days - rainy_days
    'UC_days = UC_days

end if

        if UC_days = 5 then
            cost2date = rsSite("siteDeliveryCost") +
((rsSite("siteTravelCost") + 2000) * 5)
        else
            cost2date = (rsSite("siteTravelCost") + 2000) *
UC_days
        end if
        profit2date = rsJob("jobPrice") - cost2date

        Const_Start = rsJob("jobBeginDate") + 1
        Const_End = Const_Start + rainy_days + 4

        total_cost2date = total_cost2date + cost2date

tmp1 = rsJob("ctrID")
tmp2 = Request.Cookies("robbid")("usrID")

tmp1 = clng(tmp1)
tmp2 = clng(tmp2)

if tmp1 = tmp2 then
    %>
<tr>
    <td width="2"></td>
    <td ALIGN="CENTER"><%=rsJob("jobID")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER"><%=rsSite("siteLocation")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER">$ <%=rsJob("jobPrice")%></td>
    <td width="2"></td>
    <td ALIGN="CENTER">Day <%=Const_Start%></td>
    <td width="2"></td>

```

```

<td ALIGN="CENTER"><%=rainy_days%>days</td>
<td width="2"></td>
<td ALIGN="CENTER"><%=UC_days%>days</td>
<td width="2"></td>
<td ALIGN="CENTER">$ <%=cost2date%></td>
<td width="2"></td>
</tr>
<%
    end if

    if UC_days = 5 then
        response.redirect "info_after.asp?JID=" & rsJob("jobID")
        & "&cstrCost=" & cost2date & "&cstrProfit=" & profit2date & "&cstrDelay=" &
        rainy_days & "&cstrUC=" & UC_days & "&cstrBeginDate=" & Const_Start & "
        &cstrEndDate=" & Const_End
    end if
    set rsWeather = nothing

    rsJob.movenext
    Loop
    Set rsJob = nothing

    end if

%>
<tr>
<td colspan="15"></td>
</tr>
</table>
<!-- ##### Table for Jobs in Progress [END] ##### -->
<!-- ##### Table for COMPLETED JOBS [START] ##### -->
<BR>
<br>
<br>
<table border="1" frame="void" rules="rows" bordercolor="#dddddd"
cellpadding="0" cellspacing="0" style="border-collapse: collapse;" width="100%">
<tr>
<td bgcolor="#6699CC" width="2"></td>
<td bgcolor="#6699CC" colspan="19"><B>My Completed jobs</B></td>
<td bgcolor="#6699CC" width="2"></td>
</tr>
<tr>
<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">Job#</td>

```

```

<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">Site</td>
<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">Bid Date</td>
<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">Bid Amount</td>
<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">Cost</td>
<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">Profit</td>
<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">Start day</td>
<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">End day</td>
<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">Rainy days</td>
<td bgcolor="#dddddd" width="2"></td>
<td bgcolor="#dddddd" ALIGN="CENTER">Profit Rate</td>
<td bgcolor="#dddddd" width="2"></td>
</tr>

```

```
<%
```

```

        mySQL = "SELECT * FROM tblJob Where jobConstEnded=1 And
ctrID=" & ctrID
        set rsJob = Conn.Execute(mySQL)

        if not rsJob.EOF then

            Do until rsJob.EOF

                mySQL = "SELECT * FROM tblSite Where siteID =" & rsJob("siteID")
                set rsSite = Conn.Execute(mySQL)

                mySQL = "SELECT * FROM tblBid Where jobID =" & rsJob("jobID")
                set rsBid = Conn.Execute(mySQL)

                mySQL = "SELECT * FROM tblConstruction Where jobID =" &
rsJob("jobID")
                set rsCstr = Conn.Execute(mySQL)

                mySQL = "SELECT * FROM tblContractor Where ctrID =" &
rsJob("ctrID")
                set rsCtr = Conn.Execute(mySQL)

```

```

pProfit = (rsCstr("cstrProfit")/rsJob("jobPrice"))
pProfit = FormatPercent(pProfit, 2, -1, 0, 0)
'response.write(rsCstr("cstrProfit"))
'response.write("<Br>")
'response.write(rsJob("jobPrice"))

%>
<tr>
  <td width="2"></td>
  <td ALIGN="CENTER"><%=rsJob("jobID")%></td>
  <td width="2"></td>
  <td ALIGN="CENTER"><%=rsSite("siteLocation")%></td>
  <td width="2"></td>
  <td ALIGN="CENTER">Day <%=rsBid("bidDate")%></td>
  <td width="2"></td>
  <td ALIGN="CENTER">$ <%=rsJob("jobPrice")%></td>
  <td width="2"></td>
  <td ALIGN="CENTER">$ <%=rsCstr("cstrCost")%></td>
  <td width="2"></td>
  <td ALIGN="CENTER">$ <%=rsCstr("cstrProfit")%></td>
  <td width="2"></td>
  <td ALIGN="CENTER">Day <%=rsCstr("cstrBeginDate")%></td>
  <td width="2"></td>
  <td ALIGN="CENTER">Day <%=rsCstr("cstrEndDate")%></td>
  <td width="2"></td>
  <td ALIGN="CENTER">Day<%=(rsCstr("cstrEndDate") -
rsCstr("cstrBeginDate") -4)%></td>
  <td width="2"></td>
  <td ALIGN="CENTER"><%=pProfit%></td>
  <td width="2"></td>
</tr>
<%
  Set rsSite = nothing
  Set rsBid = nothing
  Set rsCtr = nothing

  rsJob.movenext
  Loop
  Set rsJob = nothing

  else
%>
<tr>

```

```

        <td ALIGN="CENTER" colspan="21"></td>
    </tr> </tr>
    <td ALIGN="CENTER" colspan="21">There are no finished jobs</td>
    </tr> </tr>
    <td ALIGN="CENTER" colspan="21"></td>
</tr>
<%
    end if
%>
</tr>
    <td colspan="21"></td>
</tr>
</table>
<!-- ##### Table for COMPLETED JOBS [END] ##### -->
<%
    mySQL = "SELECT * FROM tblJob Where jobBidClosed=1 And
jobConstEnded = 0 And ctrID=" & ctrID
    set rsJob = Conn.Execute(mySQL)

    mySQL = "SELECT * FROM tblConstruction Where ctrID=" & ctrID
    set rsCstr = Conn.Execute(mySQL)

    mySQL = "SELECT * FROM tblContractor Where ctrID =" & ctrID
    set rsCtr = Conn.Execute(mySQL)

    count = 0
    Do until rsJob.EOF
        Count = count + 1
    rsJob.movenext
    Loop
    count = rsCtr("ctrCapacity") - count

    l_capacity = rsCtr("ctrCapacity") - 3

    total = 0
    Do until rsCstr.EOF
        total = total + rsCstr("cstrProfit")
    rsCstr.movenext
    Loop
    total2 = total + 40000 - total_cost2date - rsCtr("ctrLoan")
    'response.write ("TESTING to fix total your financial condition")

```

```

        'response.write ("<br>")
        'response.write (total_cost2date)
        'response.write ("<br>")
        'response.write (rsCtr("ctrLoan"))

    %>
<BR>
<BR>
<fieldset>
<legend>My summary</legend>
<table border="0" cellpadding="15" cellspacing="0" style="border-collapse:
collapse" bordercolor="#111111" width="95%" id="AutoNumber1" height="100">
<tr>
<td width="100%" valign="top"><%
    <ul>
        <li> Current Spare Capacity For Additional Work : <B><%=count%></B>
[ Your total capacity : <%=rsCtr("ctrCapacity")%> (Initial capacity : 3, Added capacity
by bank guarantee : <%=l_capacity%>]<BR>
        <BR>
        <li> Current Financial Condition : <B>$ <%=total2%></B> ( No money paid
to initiate work, No money paid in middle of job)<br>
[ = Capital money [$40000] + Profits from completed jobs - Costs of current jobs in
progress - Bank Guarantee Fee($500/loan)]<br>
Current My Total Bank Guarantee Fee : $ <%=rsCtr("ctrLoan")%>
    </ul>
    <% if total < 0 then%>
    <CENTER>
        <FONT SIZE="" COLOR="red"><B>You are bankrupt.</B></FONT><BR>
        <BR>
    </CENTER>
    <%end if%>
</td>
</tr>
</table>
</fieldset>
<br>
<%
    set rsCtr = nothing
    set rsCstr = nothing
    set rsJob = nothing
    %>
</td>

```

```

        </tr>
    </table>
</div>
</BODY>
</HTML>
<!--#include file="db_close.asp"-->
A.17 INFO_BEFORE.ASP

```

```

<%
    response.redirect "info.asp"
%>

```

A.16 INFO_AFTER.ASP

```

<!--#include file="db_open.asp"-->
<%
ctrID = Request.Cookies("robbid")("usrID")
jobID = request("JID")
cstrCost = request("cstrCost")
cstrProfit = request("cstrProfit")
cstrDelay = request("cstrDelay")
cstrUC = request("cstrUC")
cstrBeginDate = request("cstrBeginDate")
cstrEndDate = request("cstrEndDate")

mySQL="INSERT INTO tblConstruction (ctrID, jobID, cstrCost, cstrProfit, cstrDelay,
cstrUC, cstrBeginDate, cstrEndDate) " _
&"VALUES ("& ctrID &", "& jobID &", "& cstrCost &", "& cstrProfit &", "&
cstrDelay &", "& cstrUC &", "& cstrBeginDate &", "& cstrEndDate &")"
set rsTemp=conn.execute(mySQL)
set rsTemp = nothing
response.write (mySQL)

mySQL="UPDATE tblJob SET "
mySQL=mySQL & " jobConstEnded=1"
mySQL=mySQL & " WHERE jobID=" & jobID
set rsTemp=Conn.execute(mySQL)

```



```
set rsTemp = nothing
```

```
%>  
<!--#include file="db_close.asp"-->  
<%  
    response.redirect "info_before.asp"  
%>  
A.18 LIST.ASP
```

```
<%  
UID = Request.Cookies("robbid")("usrID")  
response.write (UID)  
%>
```

A.19 LOGOUT.ASP

```
<%  
Response.Cookies("robbid")("usrID") = ""  
response.redirect "index.asp"  
%>
```

